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UNIDEX™ 11
MOTION CONTROLLER
PROGRAMMING MANUAL

PN: EDU103

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ORGANIZATION OF DOCUMENTATION FOR UNIDEX 11:

Up to four manuals may have been shipped with your Unidex 11 Controller, depending on the options ordered. Of the four manuals, two supply basic data regarding programming and hardware support information. These manuals are respectively:

- *Unidex 11 Motion Controller Programming Manual*—which is this manual
- *Unidex 11 Motion Controller Hardware Manual*

Depending on the options supplied with your Unidex 11, one or both of the following documents may have also been supplied:

- *Unidex 11 Motion Controller Options Manual*
- *Unidex 11 Interactive Control Software Manual (SSP1)*

Please review in detail this manual, *Unidex 11 Motion Controller Programming Manual*, before proceeding to other documentation.

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ORGANIZATION OF THIS MANUAL:

This manual is divided into four distinct parts, each treated as a separate manual with its own Table of Contents and Index. These four parts are:

Part I: Introduction to Unidex 11
Part II: Menu-Driven Front Panel Programming of the Unidex 11
Part III: Programmable Acceleration/Deceleration for the Unidex 11
Part IV: RS-232 Serial Interface Programming of the Unidex 11

Information on Service and Repair, as well as Warranty information, is located at the back of the manual.

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PART I

INTRODUCTION TO THE UNIDEX 11

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CHAPTER 1: GENERAL DESCRIPTION

Unidex 11 is a multi-axis (1 through 4 axes) microprocessor-based motion controller. It is available in four packages: a 3U (6" high one to two axes) desktop cabinet (model U11M), a 6U (12" high) one to four axis desktop cabinet (model U11S), a 6U high 19" rack mount chassis (model U11R), and a high power 19" rack mount chassis for heavy duty applications (model U11H). All four configurations are shown in figure 1-1. The latter three configurations are capable of one through four axes of motion control, and are capable of both closed loop DC brush servo and open loop stepping drive control. Any combination of closed loop DC drives or open loop stepping drives can be accommodated. That is, drives can be "all" DC or "all" stepping, or any combination of the two. (The 3U high two-axis package is only capable of open loop stepping drive control, using the D or DM Series stepping drives.)

Table 1-1 lists specifications for various standard DC motor/drive combinations available with Unidex 11.

Table 1-2 lists various standard stepping motor/drive combinations available with Unidex 11.

Torque vs. speed specifications for DC motor/drive and stepping motor/drive combinations (listed in tables 1-1 and 1-2) are shown respectively in figures 1-2 and 1-3.

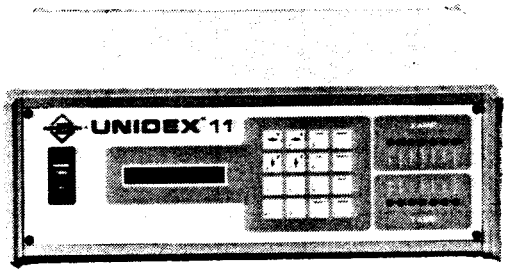
Note that for the DC motor/drive torque speed curves of figure 1- 2, only one DC servo drive amplifier module is used for all motor combinations (1017LT through 1410LT). The drive amplifier varies only in its DC bus voltage specification. This voltage is supplied by a central power supply within the given chassis. This power supply can be configured to supply various levels of DC bus voltage to the

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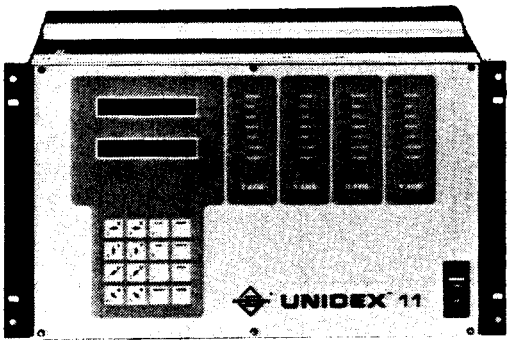
DSL8020. (See user manual *Unidex 11 Motion Controller Hardware Manual* for more information).

As for the stepping motor/drive torque speed curves of figure 1-3, a given stepping motor (50SM through 1010SM) is matched to a unique stepping translator drive module, (except for the 310SM and 510SM motor, which uses the same DMV8008 stepping drive module). See user manual *Unidex 11 Motion Controller Hardware Manual* for more information.

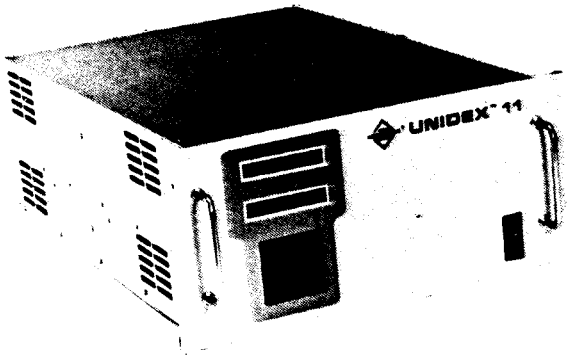
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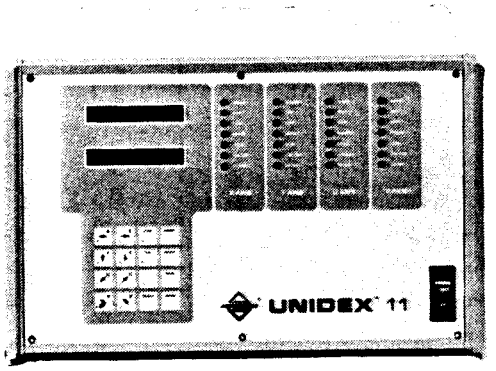
3U Desktop Cabinet
Model U11M



6U 19" Rack Chassis
Model U11R



High Power 19" Rack Chassis
Model U11H



6U Desktop Cabinet
Model U11S

Figure 1-1: Unidex 11 Programmable Multi-Axis Motion Control Family

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DC DRIVE P/N	DSL8020	DSL8020	DSL8020	DSL8020	DSL8020	DSL8020
DC MOTOR P/N	1017LT	1050LT	1075LT	1135LT	1210LT	1410LT
Continuous Torque (Max.)						
(Oz-In)	17	50	75	135	210	410
(N-m)	0,12	0,35	0,53	0,95	1,5	2,9
Peak Torque (Max.)						
(Oz-In)	82	186	280	490	700	890
(N-m)	0,58	1,31	2,0	3,46	4,94	6,28
Maximum Speed						
(RPM)	6500	4400	5000	3600	2500	1800
Motor Rotor Inertia						
($Oz\text{-}In\text{-}Sec^2$)	.004	.008	.023	.052	.130	.180
($Kg\text{-}M^2$)	$0{,}028 \times 10^{-3}$	$0{,}057 \times 10^{-3}$	$0{,}16 \times 10^{-3}$	$0{,}36 \times 10^{-3}$	$0{,}92 \times 10^{-3}$	$1{,}3 \times 10^{-3}$
DC Drive Amplifier Settings						
(DC Bus Voltage)	40	40	80	80	80	80
(Max. Peak Current)	20	20	20	20	20	20
(Output Fusing, Amps)	4	5	5	5	$6\ ^{1/4}$	8
Weights						
Motor (Lbs)	1.7	4	7	9.8	10.8	15
(Kg)	0,77	1,82	3,2	4	4,9	6,8
Motor Frame						
NEMA 2	23	23	34	34	42	42
Maximum Input DC Drive Power (Watts)	90	145	170	240	260	430
Maximum Output Motor Shaft Power (Watts)	60	115	140	200	220	380

Table 1-1: DC Motor/Drive Specifcations for the Unidex 11

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STEPPING DRIVE P/N	DM4001	DM4005	DM6006	DMV8008	DMV8008	DMV16008
STEPPING MOTOR P/N	50SM	101SM	300SM	310SM	510SM	1010SM
Static Torque						
(oz-in)	38	90	350	370	520	1050
(N-m)	0,27	0,64	2,47	2,61	3,67	7,41
Motor Speed						
RPM	1500	2000	2000	2000	2000	2000
Motor Rotor Inertia						
Oz-In-Sec^2	1.66E^{-3}	5E^{-3}	26.5E^{-3}	26.5E^{-3}	55E^{-3}	114E^{-3}
Kg-M^2	11.8E^{-6}	35E^{-6}	187E^{-6}	187E^{-6}	388E^{-6}	805E^{-6}
Motor Frame						
NEMA2	23	23	34	34	42	42
Motor Type	2-Phase Hybrid Permanent Magnet, 1.8/Full Step					
Stepping Drive						
Volts (DC)	40	40	60	80	80	160
Amps	1	5	5.5	6	8	8
Type	Unipolar	Unipolar	Bipolar	Bipolar	Bipolar	Bipolar
Weights						
Motor (Lbs)	2.3	3.6	8.1	8.1	14	20
(Kg)	1.05	1.64	3.68	3.68	6.36	9.09
Maximum Input						
Stepping Drive Power (Watts)	25	80	140	290	280	460
Maximum Output						
Motor Shaft Power (Watts)	12	53	100	250	220	400

Table 1-2: Stepping Motor/Drive Specifications for the Unidex 11

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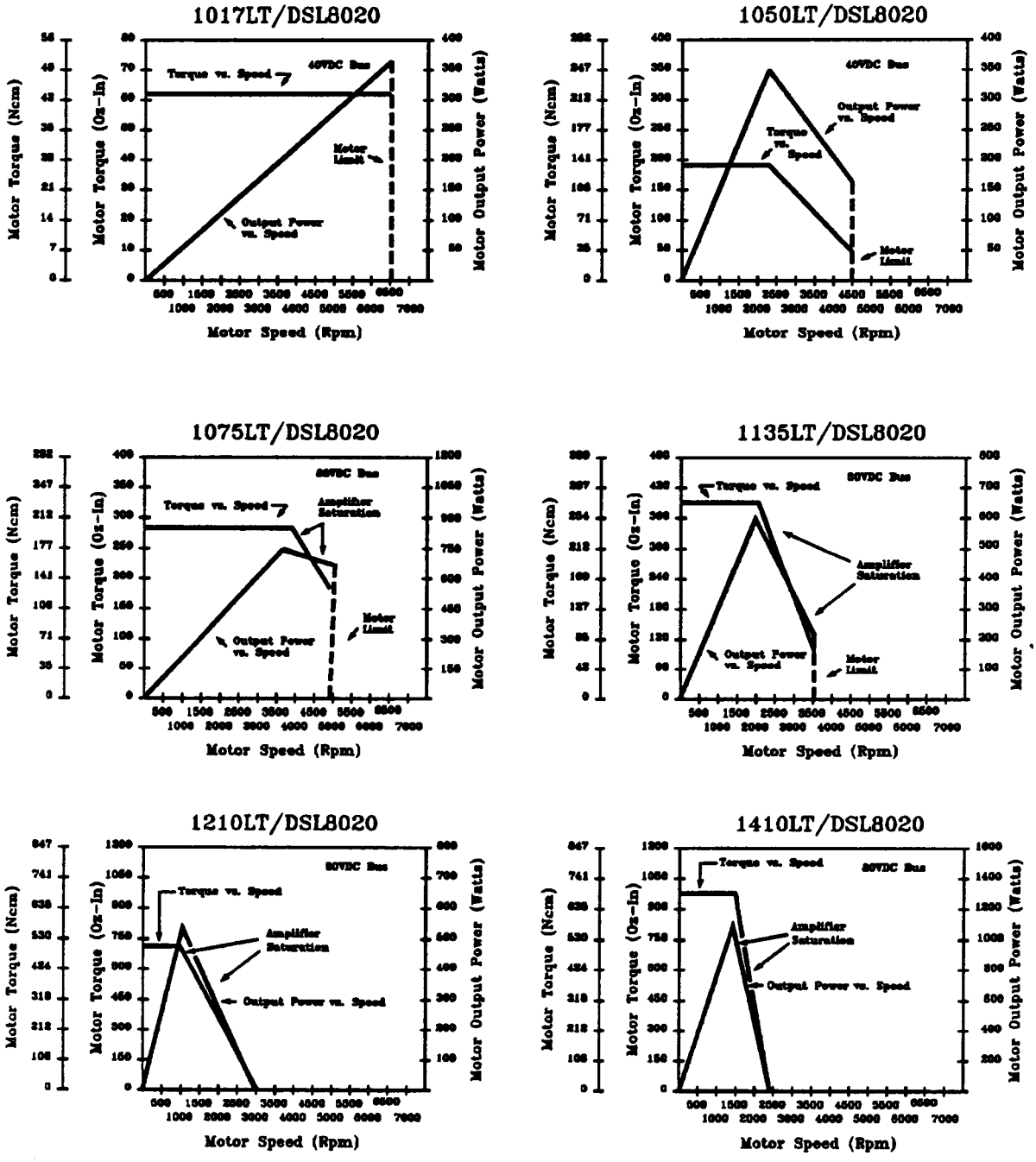


Figure 1-2: DC Motor/Drive Torque vs. Speed Specs

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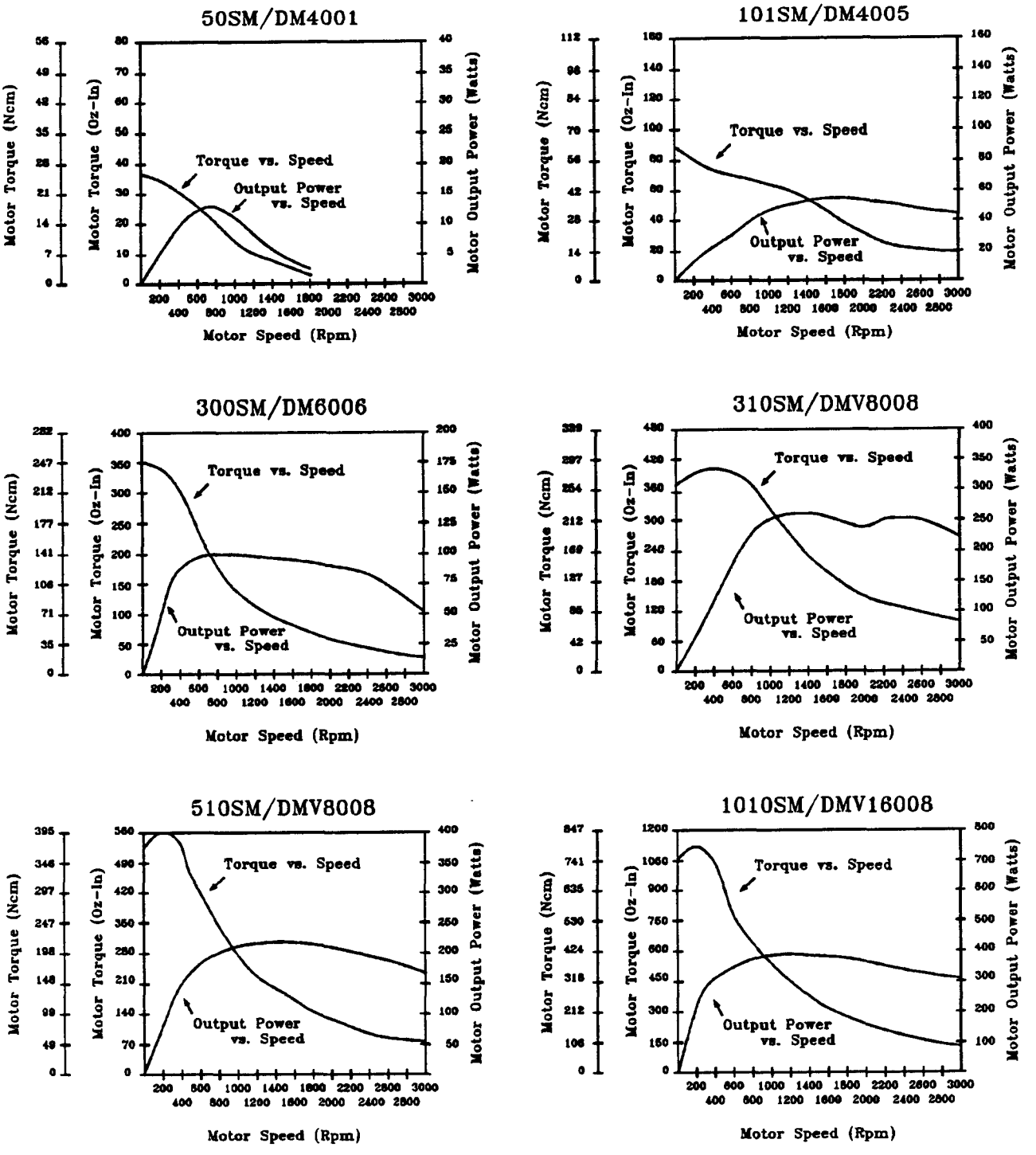


Figure 1-3: Stepping Motor/Drive Torque vs. Speed Specs

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CHAPTER 2: UNIDEX 11 PRODUCT SUMMARY

SECTION 2-1 ABOUT THIS MANUAL

The Unidex 11 family of controllers contains many standard and optional features, organized into a highly compact structure. These features constitute both hardware (control board, DC and stepping drives, and power supply) and a menu driven control interface, all housed in a single and highly rigid chassis.

The hardware and software control structure of Unidex 11 is designed to be highly versatile, and can fill a multitude of applications using only the standard configuration.

This section summarizes the standard and optional features of the Unidex 11. References to the main body of this manual are provided to direct the user to more specific information regarding the various programming functions of the Unidex 11.

Hardware specifications (i.e., cable connections for the optional JP4 Joystick, the TDT program selection module, etc.) are contained in a separate manual (see the *Unidex 11 Motion Controller Hardware Manual*). The hardware manual provides specific information regarding the DC servo amplifier module DSL8020, stepping translator modules D1401, D3001, DM1501, DM4001, DM4005, DMV8008 and DMV16008, as well as information regarding the connections of external peripherals.

Information on options for Unidex 11 (e.g. options pertaining to programming) can be found in two other documents. They are *Unidex*

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11 Motion Controller Options Manual and *Unidex 11 Interactive Control Software (SSP1) Manual.*

NOTE: **These documents are only supplied if the given option is installed in Unidex 11.**

SECTION 2-2 UNIDEX 11 CONTROL SUMMARY

A. FRONT PANEL CONTROL & PROGRAMMING

The Unidex 11 provides a menu-driven format to facilitate front panel programming. Every controller operation is available through the menu screens. There are no special codes or key words to remember, the operator simply makes a mode selection from the main menu, steps through the mode menu until the desired function appears, then either enters data or performs the function using the keys indicated on the display. See Part II (*Programming Unidex 11 Through Menu-Driven Front Panel*) of this manual for specific information regarding front panel programming.

B. EXTERNAL CONTROL AND PROGRAMMING

Programming commands can also be input through one of the remote interfaces to the Unidex 11. The following sample of commands are used to construct motion programs in the Unidex 11 through the remote RS-232 serial interface (standard interface) or the IEEE-488 parallel interface (the optional interface explained in the *Unidex 11 Motion Controller Options Manual*). Specific information regarding the external programming of the Unidex 11 through the RS-232 Interface is outlined in Part IV of this manual.

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Motion Commands

AB	Set absolute mode position tracking
ADnnnn	Accel/decel ramp time to nnnn milliseconds
Ha	Axis a home (see note).
IN	Set incremental mode position tracking
ITvvvv	Wait until input state I1, I2, I3, I4 matches vvvv where v = 1,0,X
Avddddddddddd	Load position register a with ddddddddddd and direction v where v = + or - (see note).
Ra	Start free run axis a after stop (see note).
Sa	Stop free run axis a (see note).
a Ffffffff Dvddddddddddd	Axis a move at feedrate ffffff steps/sec a distance of ddddddddddd steps in direction v where v = + or - (see note).
a Ffffffff Rv	Axis a free run at feedrate ffffff steps/sec in direction v where v = + or - (see note).

Note: Axis a indicates the X, Y, U or V axis.

I/O and Program Flow Commands

BF	Turn beeper off
BN	Turn beeper on
DBnnn	Set digital output to nnn BCD format
DDnnnn	Set digital output to nnnn (0 to 4095) in binary format
CS nn I vvvv	GoSub label #nn if input state is vvvv where v = 0,1,X (true, false, don't care), else continue
CT nn I vvvv	GoTo label #nn if input state is vvvv where v = 0,1,X (true,false,don't care), else continue
GSnn	GoSub label #nn

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GTnn	GoTo label #nn
LBnn	Assign label #nn to a command block
PS	Program stop (end of program execution)
RCvvvv	End repeat loop on input state vvvv where v = 1,0,X (true, false, don't care)
RE	Repeat loop end
RP	Repeat program
RSnnnn	Repeat loop start, nnnn repetitions
SR	Subroutine return

Edit Commands

Enn	Begin downloading program #nn. Existing program #nn will be deleted automatically
E $ nn	Delete program #nn
E $ 00	Clear program memory (all programs)
%	End edit (downloading)

Print Commands

F	Insert block (line) numbers when printing programs (for editing purposes)
G	Cancel block (line) number printing (default)
PD	Print directory listing
Pnn	Print program #nn
PS	Print status bytes
Pa	Print a axis position register value (a = X,Y,U or V)
P00	Print all programs in memory
Q	Query (serial poll); Unidex 11 returns first status byte

Mode Commands

Ann	Run program #nn in Auto mode
Bnn	Run program #nn in Block mode (subsequent <LF> will execute successive program blocks)
D	Cancel R or S command

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I (string)	Execute program block (string) in the Immediate mode ("String" is any valid motion program command)
L	Put Unidex 11 in Local-with-Remote-Enabled mode
O	Cancel Hold mode (default)
R	Enable Remote mode from host (with JP4C, HSBI, PSWD only)
S	Enable Joystick mode from host (with JP4C, HSBI, PSWD only)

Initialization Commands

C	Reset Unidex 11 to power up conditions
J	Set up Unidex 11 to send service request after execution
K	Cancel set-up to send service request (default)
M	Set up to transmit status in binary format (default)
N	Set up to transmit status in hex-ASCII format
T	Trigger to start program execution

SECTION 2-3 APPLICATION PROGRAM EXAMPLE

The following application example illustrates the programming versatility of the Unidex 11 controllers.

For this example, the program is written for transmission through the external RS-232 or IEEE-488 interface. Of course, this program example could have just as easily been written in the "menu driven" format (the front panel operation).

APPLICATION: A product is to be automatically inspected for flaws using an eddy current probe. Any flaws are to be sent to and mapped by a host computer.

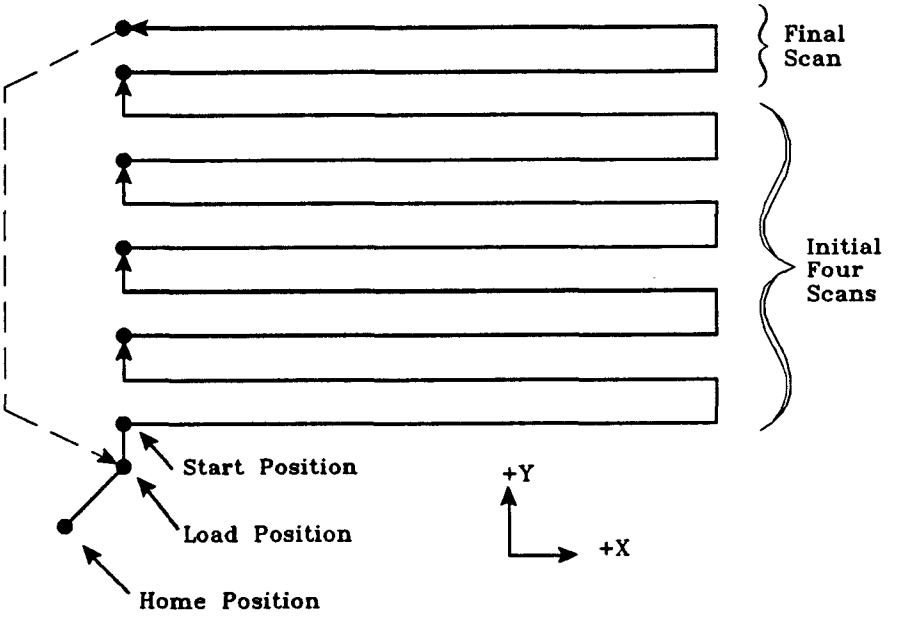
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SOLUTION: A two-axis Unidex 11 controls an X-Y linear stage to produce a raster scan pattern. "On-the-fly" position data is sent to a host computer via an SEO (Serial-Clock Output) option. System resolution is 0.001 in/step.

Command	Description
HXY*	Home axes
IN*	Set incremental mode
NC*	Non-corner-rounding mode
AD200*	Set accel/decel ramp time to 200 mSec.
LB10*	Label 10
OT1XXX*	Set output 01 ON to signal operator
CS15I1XXX*	GoSub label 15, if input I1 is ON (run scan)
CT20IX1XX*	GoTo label 20, if input I2 is ON (quit and go home)
GT10*	GoTo label 10
LB20*	Label 20
OT0XXX*	Turn OFF operator signal
HXY*	Home axes
PS*	Program end
LB15*	Label 15 (subroutine)
OT01XX*	Turn off operator signal and activate probe (output O2 ON)
YD600*	Advance to start position
RS4*	Repeat loop start; repeat four times
XF4000D40000*	
YF6000D200*	Basic scan repeated four times
XD-40000*	
YD200	
RE*	End repeat loop
XD40000*	
YD200*	Final scan
XD-40000*	
OTX0XX*	Deactivate probe

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AB*	Set absolute mode
XD1000	Return to load position
YD400*	
IN*	Set incremental mode
SR*	End subroutine



NOTE: An additional programming example for Unidex 11 involving menu driven (front panel) input can be found in appendix 1 of Part II of this manual.

SECTION 2-4 STANDARD AND OPTIONAL ACCESSORIES

The Unidex 11 can be equipped with a number of options to enhance its versatility. In addition, several accessories are available for the Unidex 11 to complete a high performance motion control system. Descriptions of the major options and accessories follow.

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A. MODELS JP4,JP4C,JP4D JOYSTICK CONTROLS (OPT)

- Three joystick options: standard, computer-enabled and digitizing
- Controls up to 4 axes
- High/low speed select button
- Independent, programmable speed scaling of each axis

The Unidex 11's three joystick options utilize the same joystick actuator which features two-axis simultaneous control, an axis- pair select button (X and Y/ U and V), a speed change button and a third, bat-handle button used to execute a program.

The general purpose joystick control (JP4 option) is outlined in Part II of this manual (section 2-2 H). The JP4D option is similar to JP4, but adds the capability of joystick position digitizing (see *Unidex 11 Motion Controller Options Manual* for more information).

The JP4C option enables control of the joystick mode from a host computer connected to the Unidex 11. The JP4C option allows position digitizing in four axes by allowing the host to access position registers on the Unidex 11 through program control. (See *Unidex 11 Motion Controller Options Manual* for more information.)

Joystick Specification

Control Features	Direction and proportional velocity for two orthogonal axes
	High/low speed select
	Axis pair (X,Y or U,V) and feedhold select
	Program execute or position digitize select
Scaling	Programmable speed scaling per axis: 250,000:1 ratio

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Size	3.9"H x 3.9"W x 4.25"D (99mm x 99mm x 108mm)
Weight	0.7 lbs (0,32 kg), including cable
Cable	5 ft. (1,5m) with 15-pin connector

B. MODEL SSP-1 SOFTWARE SUPPORT PACKAGE

The SSP-1 Software Support Package is a powerful motion program development aid that harnesses the power and memory capacity of any PC/XT/AT compatible computer for use with the Unidex 11. This software adds linear and circular interpolation capabilities to the Unidex 11.

Menu-assisted program creation and editing make even complex multi-axis motions easy to develop. Programs can be downloaded to the Unidex 11, or run from a PC with the Unidex 11 in the immediate mode. Motion status display, program position digitizing (with the JP4C or JP4D accessories) and program transfer and print are some of the additional capabilities of this versatile development tool. For more information, see *Unidex 11 Interactive Control Software Manual.*

SSP-1 Specifications

Hardware required	PC/XT/AT or compatible, running PC-DOS or MS-DOS 2.10 (or later)
Memory required	384KB minimum
Program medium	5 1/4" floppy disk
Interface	RS-232C

C. I488 COMMUNICATION INTERFACE (IEEE-488)

The optional IEEE-488 (GPIB) interface for the Unidex 11 replaces the standard RS-232C serial interface. The Unidex 11 functions as both a listener and a talker, so interactive control and up-

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loading of status, data and program information to a host controller are possible. (See *Unidex 11 Motion Controller Options Manual* for more information.)

NOTE: The High Speed Binary Interface option (HSBI) is not available on a Unidex 11 equipped with the IEEE option.

D. DIO DIGITAL INPUT/OUTPUT INTERFACE

The DIO option provides a port to output up to 12 bits of information (software configuration as binary or 3-digit BCD), or to input 2-digit BCD to call and execute up to 99 stored programs. The input configuration also provides two lines to serve as READY and ERROR indicators. Both the input and output configurations provide a strobe line to coordinate interfacing.

DIO in the binary output configuration could be connected to a D/A converter to provide an analog representation of selected data. Alternately, in the input mode a PLC could be used to coordinate the calling and execution of programs in one or more Unidex 11 controllers.

NOTE: DIO interconnect wiring should be limited to 5 feet (1.5m). (See *Unidex 11 Motion Controller Options Manual* for more information.)

NOTE: The High Speed Binary Interface option (HSBI) is not available on DIO-equipped Unidex 11s.

E. SEO SERIAL OUTPUT INTERFACE

The SEO (Serial Output) option makes Unidex 11 position information available for external use. CW clock, CCW clock, and marker (or reset) signals are available with DC drives. Clock, direction, and

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marker (or reset) signals are available with stepping motor drives. All signals can be optically isolated.

Each SEO board provides outputs for two axes, so two SEO boards are needed for a three or four axes Unidex 11. The SEO option is applicable for DC servo and stepping motor control. However, it should be noted that for DC control (through the DSL8020 servo amplifier module), separate CW and CCW clock signals are provided as standard output connections without the SEO option. However, these outputs are not "opto-isolated" as in the case of the SEO option. (See *Unidex 11 Motion Controller Hardware Manual* for more information.)

F. HSBI HIGH SPEED BINARY INTERFACE

The HSBI option provides an 8-bit, high-speed (up to 80KB/sec.) parallel interface that can be used with a host PC that has direct memory access (DMA) capability.

Unlike the RS-232C and IEEE-488 interfaces, motion commands are communicated with HSBI in a binary format that reduces the computational overhead time of the Unidex 11. The result is a very high performance motion controller/host computer combination.

Aerotech has available a cable accessory, model MBI, which is a shielded cable and interface circuitry assembly, specifically designed to interface the Unidex 11 HSBI port to a Metrabyte Corporation PDMA-16 high speed interface board. (See *Unidex 11 Motion Controller Options Manual* and *Unidex 11 Motion Controller Hardware Manual* for more information.)

NOTE: The I488 and DIO options are not available when the HSBI option is installed.

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G. MODEL TDT PROGRAM SELECTOR MODULE

The TDT Program Selector Module is an inexpensive operator interface for the Unidex 11. Any of up to 99 programs can be selected and started using the TDT. With the TDT there is no risk of inadvertent program loss or alteration by the operator. (See *Unidex 11 Motion Controller Options Manual* for more information.)

TDT Specifications

Program Selection	Nos. 01 to 99; 00 initializes the TDT
Program Entry	2-digit thumbwheels and execute button
Communication	2-segment BCD
Power	5VDC, 50mA (supplied by Unidex 11)
Size	6.25"H x 3.75"W x 2"D (159mm x 95mm x 551mm)
Weight	1.4 lbs (0,65 kg), including cable
Cable	10 ft. (3m) with connector
Other	Requires DIO option to operate

H. 14KTM EXTENDED USER MEMORY

Unidex 11 can be equipped with an additional 8K Byte battery backed memory over and above the standard 6K Byte battery back- up. 14K battery backed memory is a factory selected option.

I. PSWD (PASSWORD) SYSTEM SECURITY CONTROL

The PSWD option allows controlled access to program editing and system parameter selections in the Unidex 11. Operator program execution and manual control are unaffected by PSWD. Password sys-

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tem security control is a factory selected option. This option is not available with the HSBI option nor the JP4D accessory.

J. POSITION RESOLUTIONS

Broad resolution ranges are available for the stepping and servo drivers used in the Unidex 11. This adds additional application flexibility not found in competing products.

Stepping resolution selection is accomplished by changing two ICs on the appropriate stepping drive module (i.e., DM4001, DM4005, etc.). (These ICs are factory selected). DC servo resolution selection is accomplished by the appropriate selection of the incremental feedback encoder. Further manipulation of feedback resolution is accomplished by selecting "XI", "X2" or "X4" feedback multiplication on the DC servo drive module (DSL8020).

STEPPING RESOLUTIONS: The range is 400 to 50,000 steps per revolution in 200 step increments. NOTE: 200 steps/rev. is available, but not recommended for most applications.

SERVO RESOLUTIONS: Available servo resolutions are listed in the table below.

Suffix Code	Resolution (steps/rev)	Encoder Model	Max Speed (rpm)
-2	200	E200AS	6,500
-4	400	E200AS	6,500
-5	500	E500AS	4,800
-8	800	E200AS	6,500
-10	1000	E500AS	4,800
-20	2000	E500AS	4,800
-40	4000	E1000AS	2,400

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NOTE: **Aerotech's standard encoders are sinewave type. Unidex 11's can be set up to operate with other encoder types; consult Aerotech Sales Engineering for details.**

For more information on drive resolutions, refer to the appropriate driver section (DM4001, DM4005, DSL8020, etc.) in *Unidex 11 Motion Controller Hardware Manual.*

K. INTERCONNECTING CABLES

Various types of motor to controller interconnect cabling is available with the Unidex 11, as described below.

For DC servo and stepping motors using separate cable assemblies (disconnect at both motor side and controller side), the following cable arrangements are available.

SMS-O/	Motor-to-controller, 15 ft. (4,6m), for 50SM through 310SM motors used with U11M, U11S and U11R chassis
HP-OB/	Motor-to-controller, 15 ft. (4,6m), for 310SM motor used with U11H chassis
HP-O/	Motor-to-controller, 15 ft. (4,6m), for 510SM and 1010SM motors used with U11H chassis
DC-MSO/	Motor-to-controller, 15 ft. (4,6m) for 1017LT through 1410LT motors used with U11S and U11R chassis
MS-O/	Motor-to-controller, 15 ft. (4,6m), for 1050LT through 1410LT motors used with U11H chassis

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For DC servo and stepping motors using integral cable assemblies (cable "married" into motor assembly, no motor connector). The following cable arrangements are available (where "motor" designates 50SM, 101SM, 1050LT, etc.).

(Motor)/C2/	Motor to controller, 15 ft. (4.6m) for 50SM and 101SM motors used with U11S, U11M and U11R chassis.
(Motor)/C3/	Motor to controller, 15 ft. (4.6m) for 300SM and 310SM motors used with U11S and U11R chassis
(Motor)/DC2/	Motor to controller, 15 ft. (4.6m) for 1017LT and 1050LT motors used with U11S and U11R chassis
(Motor)/DC3/	Motor to controller, 15 ft. (4.6m) for 1075LT and 1135LT motor used with U11S and U11R chassis

Refer to *Unidex 11 Motion Controller Hardware Manual* for information regarding connections of motor, encoder and other feedback signals of other types of motors not supplied.

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PART II

MENU-DRIVEN
FRONT PANEL PROGRAMMING
OF THE UNIDEX 11

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CHAPTER 1: INTRODUCTION

SECTION 1-1 GENERAL DESCRIPTION

Unidex 11 is a microprocessor-based motion controller, capable of running up to 4 axes of DC servo or open loop stepping motors.

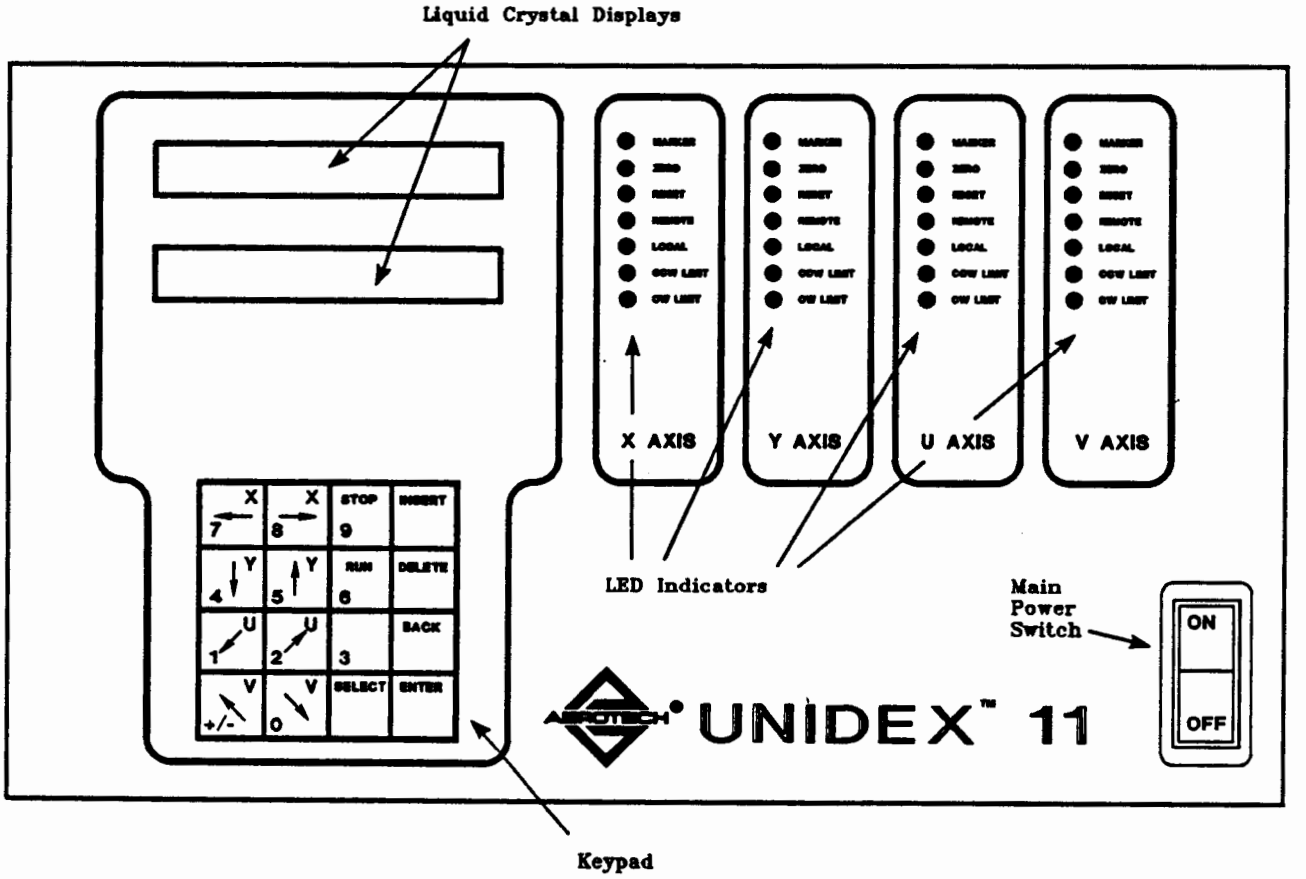
This motion controller is totally menu-driven. All menus and the tracking display are shown on two liquid crystal displays (LCDs) located on the front panel. A 4 x 4 keypad is provided for program generation, editing and manual controls. Four sets of LED indicators for axes X, Y, U and V states are also located on the front panel. (See figure 1-1.)

With the standard 6 kilo-byte battery-backed RAM, the Unidex 11 has the capacity to store approximately:

189 4 - axis moves
240 3 - axis moves
333 2 - axis moves
545 1 - axis moves

This is distributed between 1 and 99 programs.

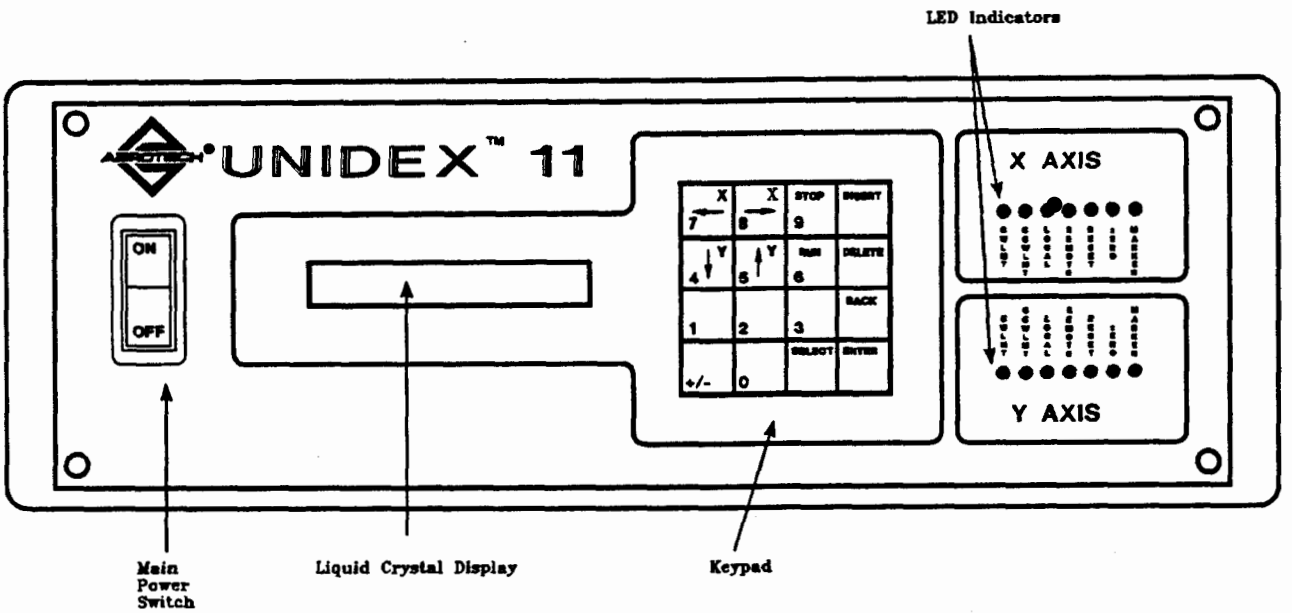
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(Models U11S and U11R shown. Model U11H is similar, but without the Front Panel LEDs)

Figure 1-1: Unidex 11 Front Panel - 4 Axis

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(Model U11M shown)

Figure 1-2: Unidex 11 Front Panel - 2 Axis

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CHAPTER 2: MODES OF OPERATION

SECTION 2-1: AN OVERVIEW

The Unidex 11 operates in a menu-driven format when programmed from the front panel. The mode of operation dictates what function a key will perform, i.e., the "context" of the operation determines the function of a key. The concepts involved are SCREEN, CHOICE and SELECT.

A SCREEN is a display. One screen is the Tracking Display. Other screens offer choices from a listed menu. Still other screens allow you to "fill in the blanks" with numbers. These are the three types of screens: Tracking Display, Menu and Data-Entry. Following is a typical example of each type:

TRACKING

j m X:	0000010000	step
j m Y:	0000015000	step

MENU

1. HOME	3. JOG/STEP
2. RUN/SLEW	4. INDEX

DATA ENTRY

RunSpd X	0010000	Step/S
RunSpd Y	5000	Step/S

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The various menu screens always appear on the upper LCD (models U11S, U11R and U11H). Tracking and data entry screens appear on the upper and lower LCDs, with X and Y axes on the upper display, U and V on the lower display (if a four-axis U11S, U11R or U11H chassis is used).

A CHOICE means to depress a number key from the listed menu (for menu screens) or to key in numbers and hit ENTER (for data-entry screens). When you make a choice from a menu screen, you may get another menu screen, a data-entry screen or the tracking display, depending on the context.

In the data entry mode, the variable to be updated is indicated by a blinking character.

When you make a choice in a data-entry screen, the system "steps you along" so that you make all entries. When you enter the item, by pressing the ENTER key in the lower right hand corner, the screen is fully entered. You may get another screen or not, depending on the context.

The SELECT button on the keypad helps you step along from screen to screen. Two cases exist. For the first, you may have a menu screen, but you don't want to make a choice from it. Pressing the SELECT key will get you the next screen that makes sense in the context. For the second, you may have the tracking display and wish for a menu, or you may have a data-entry screen and want the next one. Again, the SELECT key will step you along.

Sometimes you may wish to move backward. Just as the SELECT key moves you forward, the BACK key will back you up. This is a useful function when you have stepped to a sub-mode and wish to go back to the main menu or when editing. Also, when editing, you will need to ENTER, INSERT and DELETE. (Single purpose keys are dedicated to that function.)

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SECTION 2-2 OPERATION

WARNING: ***Before connecting motors to the Unidex 11, review the Unidex 11 Motion Controller Hardware Manual.***

After reviewing this manual, you are ready to power up. Turn on the main power switch. Unidex 11 will do a system initialization and a self-test. While the bottom display remains blank, the top display will show:

SYSTEM OK: NEW MEMORY
Press SELECT for a MENU

If you have battery back-up, you will see:

SYSTEM OK: BATT.BACKUP
Press SELECT for a MENU

The newer versions of software will display:

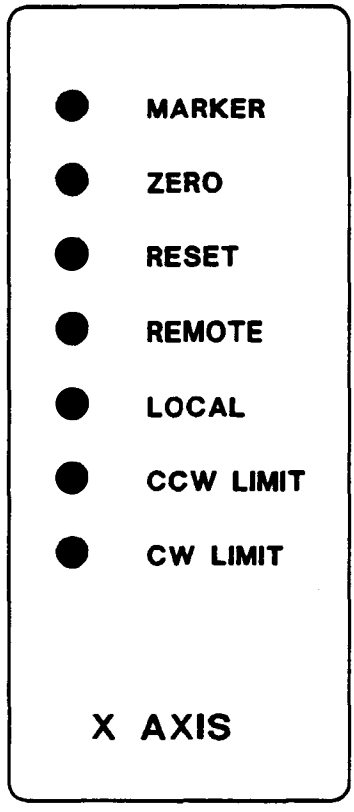
Version n.n: BATT.BACKUP (or NEW MEMORY)
Press SELECT for a MENU

where "n.n" is your version of software.

If none of these messages appear upon power-up, refer to chapter 4 of Part II of this manual (Troubleshooting).

The two or four sets (depending on your controller) of seven LED indicators on the front panel for the axes should be energized as follows:

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MARKER – ON or OFF, depending on presence of marker input signal (if used). •

(NOTE: This LED will stay energized if a marker is not being used.)

ZERO – ON, indicating axis at rest.

RESET – OFF, indicating axis is enabled for operation.

REMOTE – OFF, indicating external controls (optional) are inhibited.

LOCAL – ON, indicating keypad and/or RS-232C (optional) or IEEE-488 is enabled.

CCW LIMIT – OFF, indicating axis not in CCW limit. •

CW LIMIT – OFF, indicating axis not in CW limit. •

Press SELECT. Each time you do, you will see one of the four screens of the main menu. They are:

FIRST SCREEN

1. HOME	3. JOG/STEP
2. RUN/SLEW	4. INDEX

SECOND SCREEN

1. RUN SPEED	3. JOG INCR
2. JOG SPEED	4. JOYSTICK

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THIRD SCREEN

1. I/O	3. SETUP	5. REMOTE
2. LOAD REG	4. INC/ABS	

FOURTH SCREEN

1. EDIT PGM	3. BLOCK RUN	
2. DIRECTORY	4. AUTO RUN	

FIFTH SCREEN

1. DIG. OUT	3. COMM ENAB	
2. ACL/DCL	4. PRINT	

NOTE: Since the Edit Mode (fourth screen) is the most complex, with many subdivisions, chapter 3 has been devoted to covering this mode in detail.

The fifth screen allows access to the ACL/DCL function which is covered in Part III of this manual. It also allows you to access the RS-232 mode through the COMM ENAB function and is covered in Part IV of this manual. Also included in Part IV of this manual is an explanation of the PRINT function.

The DIG. OUT function is covered in Part IV, *Digital I/O Port*, of the *Unidex 11 Motion Controller Options Manual.*

Before proceeding with the explanation for the five main menu screens, note that explanations concerning axis selections will be limited to axis X and axis Y. Manual control and programming of the U and V axis will be similar. Units of distance for the various screens have been selected for millimeters (mm).

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FIRST SCREEN

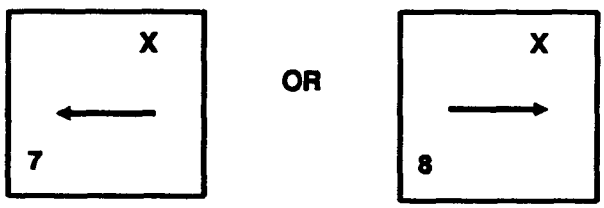
A. HOME

Press key #1 (**first screen**) to see:

"ARROW" Keys: Send Home
BACK: exit STOP: abort

NOTE: **Generally, displayed information is in upper case letters if denoting a specific key stroke and lower case letters if denoting a function.**

The "arrow" keys on the keypad allow you to send each axis home. For instance, if you press either:



the X axis would be sent home and the display would show:

X AXIS IN HOME CYCLE

When "home" is reached, you will see:

X AXIS AT HOME

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When all home cycles are complete, press BACK to go back to the first screen. (NOTE: It is not necessary to send all axes home before pressing BACK.)

To abort the home cycle, press STOP. Press SELECT to return to the first main screen.

B. RUN/SLEW

Pressing key #2 (first screen) will allow you to "slew" the axes, i.e., to move them by pressing the "arrow" keys.

s+ X: 0000009.128 mm
s m Y:- 0000009.930 mm

The system defaults to Slew (momentary run) mode indicated by "s" in the left most column of the display. Pressing an arrow key causes the relevant axis to run at a rate programmed in the RUN SPEED mode. The axis stops when the key is released. Run speeds are programmable from 1 to 999,999 steps per second in the non-accel/decel mode. However, practical system limits dictate that feedrate be limited to a maximum of 250,000 steps/second using accel/decel mode (see Part III of this manual).

The first +/- sign (after the "s") indicates if the + or - axis key is being depressed. This sign disappears after the axis key is released. The second +/- sign (before the step value) indicates if the axis position is positive or negative with respect to the absolute position of zero.

The "m" is a marker monitor and its presence indicates that a marker is present. (For more information on the marker input connection, see *Unidex 11 Motion Controller Hardware Manual*).

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If the RUN key is pressed once in the slew mode, the system switches to a free-run mode, indicated by "r" in the left most column of the tracking display. In this mode, an arrow key will start an axis running in the required direction. The "+" or "-" sign will appear next to the "r". The STOP (#9) key will stop all axes motion, and display the position registers. Press SELECT to get back to the first main menu. The keys on the right-most column (INSERT, DELETE, BACK, ENTER) of the keyboard may be used to stop the axes free run also. Each key stops the corresponding axis within the same row. For example, pressing INSERT will stop the X axis free run. Look at the letter in the left column of the display to see a change in status from "r" to "s". The axis will now be back in the slew mode. Each axis may be in the slew mode or the run mode, regardless of the other axes.

The RUN key will put the system in the free-run mode. When an axis is running, the appropriate arrow key will "bump up" (through the "→" arrow key) or "bump down" (through the "←" arrow key) the run speed by about 6% (depending on resolution) each time it is pressed. The current run speeds may be viewed by pressing the SELECT key. Both the Run and Slew modes allow you to toggle between the Run Speed screen and the Tracking Display screen through the SELECT key, and the Run mode allows you to "bump up" and "bump down" the Run Speed through the +/- arrow keys.

The BACK key takes you back to the first screen if no axis is in motion. If all axes are stopped via the STOP key, pressing SELECT will return you to the first main screen. If all axes are stopped via the keys in the right-hand column, pressing BACK will return you to the first main screen. If you wish to leave one or more axes free- running and still go back to the first screen, press key #3. When any of the axes is in the free run mode, some of the normal choices within the menu screens are not available. The system indicates this by displaying

Axis In Motion
Press BACK To Quit

whenever these choices are disabled.

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C. JOG/STEP

Press key #3 (1st screen) to enter the jog mode. Pressing directional (arrow) keys causes a relevant axis to move a preselected number of steps in the selected direction. The number of steps is programmable from 1 to 1,000,000 in the JOG INCREMENT mode (explained later). The jog speed is programmable in the JOG SPEED mode (explained later), from 1 step/sec to 500,000 steps/sec. with a resolution of 1 microsecond.

The tracking display is active during any axis motion. A letter "j" on the left most column indicates the jog mode. A sign "+" or "-" indicates the actual direction of motion while the axis is in motion. The system units are displayed on the right portion and may include steps, mils, inches, nanometers, microns, millimeters, centimeters, meters, steps, degrees, arc seconds, and arc minutes.

j m X: 000000.000 mm
j m Y: 000000.000 mm

Press BACK to return to the first main screen.

D. INDEX

INDEX is an immediate execution of an axis move. Press key #4 (first screen) for INDEX.

X
Y

To quit, press ENTER. You will see:

Press: RUN to execute
: BACK to run

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If one of the axes is already in motion (free-running), you will instead see:

WARNING Axes in Motion
ENTER: continue BACK: quit

If ENTER is pressed, free-run information is displayed. You may enter new feedrate data but if this value contains the number 9 (STOP key), the free-run will be aborted and the position registers will be displayed. (Entering data is explained in the following paragraphs.)

If the above is not the case, the axes within your system will be displayed as shown previously. Choose an axis by pressing the appropriately labeled key. For example, press X:

X
Y

The axis chosen begins to flash on the display. Press ENTER. The X axis feedrate is now displayed and flashes to indicate that you may enter the feedrate data (up to 6 digits).

X F 001.000
Y

To enter the default data, press ENTER. To enter a new value, enter digits. All feedrates are 6 digits in system units/second. When digits are entered, they will be displayed from right to left. Pressing DELETE will delete the last digit entered. Press BACK to bring back the previous data or press ENTER to enter the new data.

NOTE: The minimum feedrate resolution of Unidex 11 is 1 microsecond. Unidex 11 rounds a feedrate down to the nearest microsecond. There-

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fore, the feedrate accepted and displayed by Unidex 11 may be slightly different than what was keyed in on the keypad. For example:

30000 steps/sec Keyed In

30303 steps/sec Accepted and Displayed

After entering feedrate data, press ENTER. You will now see:

X F 002.000 D 000.000000
Y

D begins to flash, indicating that the distance data may now be entered (in 9 digits). The +/- key may be used to convert distance data to negative or positive numbers.

At this point, an axis free-run may be chosen instead of linear distance, by pressing SELECT. If you press SELECT, you will see:

X F 002.000 RUN CW
Y

The +/- key may now be used to toggle between CW and CCW at this point. Press +/- to see:

X F 002.000 RUN CCW
Y

Press ENTER to complete X axis Index entry.

The Y, U and V axes Index information may be entered in the same fashion. After entering all indexing data, press ENTER again to see:

Press: RUN to execute
: BACK to quit

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NOTE: In any manual mode, the RUN and BACK choice shown above is always given to you.

Press RUN to run the axes and show the tracking display.

Once a manual Index is complete, the information is retained. Just press key #4 when the first Screen is displayed to have this data displayed again. Press ENTER and RUN to reexecute or ENTER and BACK to quit.

If an axis is set to free-run mode external to the manual Index operation, the new status of the axis is reflected when the Index screen is brought up the next time. The indexing distance information from the previous Index operation is retained and may be recalled when the axis stops the free run.

Press BACK to quit the index mode and go back to the first screen of the main menu.

When axes are in motion, press STOP to abort all motion and display the position registers. Pressing STOP aborts free-runs, indexing and home cycles. Then press SELECT to return to the first main menu. A Feedhold (explained later) is also available to temporarily halt motion.

Also available is a softkey stop. In Jog, Manual Index and Program Run, pressing key #3 acts as a feedhold. It will not, however, stop a home cycle. It may or may not stop a free-run, depending on what has been selected in the Set-up mode.

When motion is stopped via key #3, pressing RUN will continue motion.

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E. RUN SPEED and JOG SPEED

As illustrated before, the **second screen** of the main menu is:

1. RUN SPEED	3. JOG INCR
2. JOG SPEED	4. JOYSTICK

Pressing key #1, RUN SPEED, will show:

RunSpd X	010.000	mm/s
RunSpd Y	010.000	mm/s

X is blinking when this screen comes up. To enter the default data, press ENTER. To enter a new value, enter digits. All feedrates are 6 digits in system units/second. When digits are entered, they will be entered from right to left. Pressing DELETE will delete the last digit entered. Press BACK to bring back the previous data or press ENTER to enter new data.

After pressing ENTER, press BACK to go back to the second screen of the main menu.

F. JOG SPEED

Press JOG SPEED to see:

JogSpd X	010.000	mm/s
JogSpd Y	010.000	mm/s

Data entry operations are the same as they were for RUN SPEED.

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G. JOG INCREMENT

Press JOG INCREMENT to see:

JogInc X 0010.000 mm
JogInc Y 0010.000 mm

This is the distance the axes will jog in the jog mode. The distance may be up to 7 digits in system units.

The distance to jog can only be entered through the respective axes' arrow keys. Each time an arrow key is pressed the distance in incremented (in either a positive or negative direction, depending on the arrow key pressed). The increments are: 1, 10, 100, 1000, 10000, 100000, 1000000.

Press BACK to go back to the second screen of the main menu.

H. JOYSTICK (JP4 OPTION)

Press key #4, JOYSTICK, to see:

1. X:Y 3. MODIFY DIVISOR
2. U:V 4. SELECT PROGRAM

This screen may be different if your system has the JP4D (Joystick Digitizing) Option. Refer to the *Unidex 11 Motion Controller Options Manual*, Part III, for details.

Press #1 to enable joystick to move X and Y axes. Doing this will also put you in the tracking display mode. ("JK" designation indicates the joystick tracking display mode.)

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jk X: 000000.145 mm
jk Y: 000000.000 mm

Press key #2 to enable the U and V axes. Press key #3, MODIFY DIVISOR, to enter a new joystick frequency divisor.

Press key #3 to see displayed:

Freq.Dvsr. X: 0000020
Freq.Dvsr. Y: 0000020

Press key #4, SELECT PROGRAM, to enter a program number to be run from the joystick (button "C"). If one is not chosen, the default program (program 1) will be executed. Press key #4 to see:

JOYSTICK PROGRAM : #01
SELECT:alter BACK: quit

Press BACK to go back to the joystick screen and BACK again to go to the second screen of the main menu.

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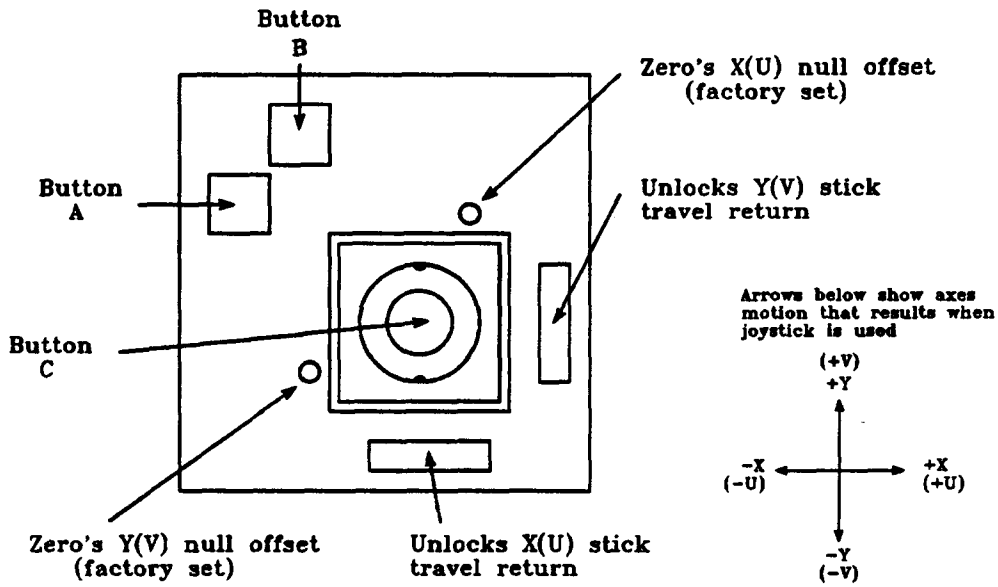


Figure 2-1: Unidex 11 Joystick

When in the joystick tracking display screen, button "A" allows you to toggle between two axis groups (X:Y or U:V). (One beep indicates X:Y active; two beeps indicate U:V active.) (Feedhold performs the same function as Button "A" during the joystick mode, i.e., selects an axis group.) During program execution, Button "A" acts as a feedhold (explained later).

Pressing button "B" will decrease joystick speed by a factor of 64 multiplied by the frequency divisor set for the given axis (explained later). Pressing Button "B" again will return the joystick to the original divisor.

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Button "C" executes a program from the joystick. Button "C" will not allow a program to run until an axis group has been selected by pressing key #1 or key #2. This button is also used for digitizing when using the joystick digitizing option (see digitizing option, JP4D, in the *Unidex 11 Motion Controller Options Manual*).

When in the joystick screen, press #3, MODIFY DIVISOR, to see:

Freq.Dvsr. X: 000020
Freq.Dvsr. Y: 000020

This number may contain up to 6 digits. It is the number by which the joystick frequency is divided. The default number is 20. (If an odd divisor is entered, Unidex 11 will round it down to an even number.)

To increase the full scale speed of the joystick, lower the number (which can go all the way down to 2).

To decrease the speed, raise the number (which can go to 999,998).

The number entered divides the base (full scale) output frequency of the joystick (approximately 360 KHz).

Data is entered and deleted as mentioned previously in the RUN SPEED section.

To increase the joystick frequency divisor by a factor of 64 times the selected divisor number (which decreases joystick speed —frequency divisor screen will show this modification), press button "B". Since this button toggles, pressing "B" again will reactivate the previous frequency. This function is particularly useful because it enables you to toggle between traverse speed and precision speed.

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In the joystick screen, press SELECT PROGRAM key (#4) to see:

JOYSTICK PROGRAM: #01
SELECT: alter BACK: quit

To enter another program number, press SELECT and enter the number. Press BACK to re-enter the joystick mode. To execute a program from the joystick, select an axis group through key #1 or key #2 and press the button on the top of the joystick (button "C").

Once a program is being executed, button "A" may be held down to stop the program (feed hold). The program will continue once button "A" is released. This button is always active and will act as a feedhold even during normal program execution or manual indexing, i.e., that which has been initiated from the front panel. After executing the program, Unidex 11 returns to the joystick mode. If any axis is in the free run mode upon returning to the joystick mode, those axes will be stopped and the position registers will be updated.

To change the program to be executed, press SELECT to see:

Input Program #
00

Now you may enter a program number. The program number can be from 1 to 99.

If you enter a program number not in memory, you will see:

INVALID PROGRAM #nn
SELECT: alter BACK: quit

Press SELECT to enter a new program number.

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Press BACK to go back to the joystick screen. Press BACK again to return to the second main screen and then SELECT to go on to the third.

I. I/O

Key #1 of the **third screen** of the main menu is I/O. Press key #1 to see:

1. OUTPUT	3. OUT:STOP
2. INPUT	4. OUT:RUN

1. OUTPUT

Press #1, OUTPUT, to see:

OUTPUT (0,1,X, & SELECT)
O1: X O2: X O3: X O4: X

O1 flashes, indicating that output may now be changed. Connections for 01 through 04 are located on the Interface board on the back of the unit. They will be explained later.

Press SELECT to jump to output to be changed. Enter 0 for a 0 output, 1 for a 1 output and X (key 7 or 8) for a "don't care" output, which leaves the output unchanged. Press ENTER to see:

Press: RUN to execute
: BACK to quit

Press BACK to cancel the new data and go back to the I/O menu above. Press RUN to enter the new data and go back to the I/O menu above.

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2. *INPUT*

In the I/O screen, press #2 key (INPUT) to see:

INPUTS (BACK to quit)
I1: 0 I2: 0 I3: 0 I4: 0

This mode allows Unidex 11 to monitor inputs in real time and to display a 0 or 1, depending on the status of the inputs (connections for I1 through I4 are located on the interface board on the back of the unit; they will be explained later). This information is available to you as long as you are in the input mode.

NOTE: For information regarding the connections to the I/O port, refer to the manual *Unidex 11 Motion Controller Hardware Manual.*

3. *OUT/STOP or OUT/RUN*

In the I/O screen, press key # 3 to see:

OUT/STOP (1,0,X & Enter)
O1: X O2: X O3: X O4: X

Press key #4 to see:

OUT/RUN (1,0,X & Enter)
O1: X O2: X O3: X O4: X

Values are entered as they were for the output mode. The values entered, however, will not be output immediately, but will instead be stored within the system to be output when you stop a program motion through the STOP key (or activate the Feedhold input) and when you continue the program motion through the RUN key (or deactivate the Feedhold input). These values are modal and will stay in effect until changed by the user or by a running program.

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As mentioned in the section on Output data, once the OUT:STOP or OUT:RUN data is entered, the following choice is given:

Press: RUN to execute
: BACK to quit

Press BACK to cancel the new data and go back to the I/O menu.

Press RUN to enter the new data and go back to the I/O menu.

Once in the I/O screen, press BACK to get in the third main screen.

J. LOAD REGISTER

Press key #2 of the third main menu screen, LOAD REG, to see:

Load X:
Load Y:

This mode presets the absolute position registers. Press any of two arrow keys of a given axis to select the desired register (X,Y) or (X, Y, U or V if yours is a 4 axis controller). The appropriate axis will start to blink on the display and you may now enter up to 9 digits (positive or negative). The position set through this command may be used to establish a temporary reference point when using the absolute mode.

The default value of the position registers is zero. For example, if you jog the X axis to a specific point, go into the Load Register mode, press an X axis arrow key and then press ENTER, the value of zero is automatically loaded into the X axis position register. Anytime after that, when in the absolute mode, entering a distance value of zero for the X axis will return it to that point.

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Once the Load Register values are entered, press ENTER again. The choice of RUN or BACK is again given to you. Press BACK to cancel the new data and go to the third main menu. Press RUN to enter the new data and go back to the third main menu.

K. SET UP

This mode allows for the set-up of certain system features. Press key #3 to see:

SELECT for next screen
+/- to change Set Up

Once in the Set Up mode, press SELECT to go through all of its screens. The BACK key will not take you back to the third main menu. You must press SELECT until all Set Up screens have been viewed. The +/- key will change the displayed data. When your choice appears, just press SELECT to enter it and move to the next Set Up screen.

Press SELECT to get:

Feedhold, Limits & Stop
LET RUN Free-Run Axes

Press +/- to toggle between LET RUN and STOP:

Feedhold, Limits & Stop
STOP Free-Run Axes

This allows a choice of letting the free-run axis or axes continue to run or to stop when program execution is aborted due to a feedhold, a soft stop (key #3) or hitting any limit (except its own limits, if any). If a free-running axis hits its own limit it will stop, regardless of the set-up. (Limit inputs are explained later.)

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Press SELECT to enter the above feature selection and see the next screen:

OUTPUTS O1, O2, O3, O4
Active Low

Pressing the +/- key will cause the output connections of Unidex 11 to toggle between true LOW and true HIGH.

LOW indicates negative logic for outputs O1 -O4 (low = 1).

HIGH indicates positive logic for outputs O1 - O4 (high = 1).

Press SELECT to see the next screen:

Position Display Units
for X axis: step

Pressing +/-, you may choose inch, mm, cm, meter, micron, nm, μinch, arcsec, arcmin, degree, rev, ft, step or mil.

NOTE: Type of unit selected acts as a label for a given axis only. The relevance of the label selected depends on motor step resolution and the mechanical system to which it is connected.

Press SELECT to see:

Number of Digits after
Point, for X axis : 3

You may choose from 0 - 6 via the +/- key.

Press SELECT to see the above two displays for each axis. There will be a "Position Display Units" display and a "Number of Digits" dis-

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play for each axis in your system. (The default for all axes is "Step" with "0" Digits After Point.)

NOTE: Digit point (or place holder) is for reference only. It is not relevant to accuracy. System resolution remains in steps relative to the least significant digit.

Press SELECT to see the next screen:

System Power-Up Default
Mode: Incremental

This function allows the user to set up the Unidex 11 to power up in either the Incremental Mode or Absolute Mode. Use the +/- key to select the mode you desire.

Additional setup screens are described in Part III and Part IV of this manual, as well as in the *Unidex 11 Motion Controller Options Manual* where relevant.

Press SELECT again to go back to screen 3 of the main menu.

L. INCREMENTAL/ABSOLUTE

When in the incremental mode, the D (distance) data indicates the system units (inches, mm, etc.) the axes are to travel. Each time the same distance data is received, the axis will travel that same amount again.

In the absolute mode, this data indicates the position on the X/Y or U/V coordinates to which the axes must travel. Once this position is attained, another distance command of the same value will cause no movement of the axes, since they are already at that position.

Press key #4, INC/ABS to see:

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Inc/Abs (+/- & Enter)
INCREMENTAL

Pressing +/- causes Unidex 11 to toggle between the absolute and the incremental modes.

The incremental/absolute command is modal, i.e., one that stays in effect until it is changed or Unidex 11 is powered down. (The default command is determined by the Set up, as described in the previous subsection.)

Press ENTER to enter your selection. Once ENTER is pressed, the RUN To Enter or BACK To Quit choice is again given to you. BACK will cancel your entry and take you to the third main menu. RUN will enter your new selection and take you back to the third main menu.

M. REMOTE

Press key #5, REMOTE, to see:

RUN: Go to Remote Mode
STOP: Reset BACK: quit

Remote mode allows optional external clock and direction signals to Stepper Drives or DC Drives. These connections are made at connectors on the back of the unit. (See the *Unidex 11 Motion Controller Hardware Manual* for more information.)

Press STOP to reset all axes. All axes are held in the reset mode until BACK is pressed. (Reset LED indicators for each axis indicate reset status.)

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Press RUN to see:

rtm X: 000000000 mm
rtm Y: 000000000 mm

The external clock and direction control connections control the tracking displays for each axis. (Note that in this mode, "Remote" LED indicators for each axis are energized). The internal position registers of the Unidex 11 are updated in this mode (i.e., alternating between remote and local mode does not alter position tracking).

Press BACK to get back to the third screen.

N. EDIT PROGRAM

Press SELECT to see the **fourth screen** of the main menu:

1. EDIT PGM	3. BLOCK RUN
2. DIRECTORY	4. AUTO RUN

The purpose of the edit mode is to enter a new program or edit an existing one.

Press key #1, EDIT PGM, to see:

Input Program #
00

Input program number 1 to 99, to enter and/or edit a program.

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Enter a number to see:

Editing Program #
nn

If program nn is already in memory, pressing ENTER will bring up the first block of the program.

When entering an existing program, a check sum and block verification routine is performed. If statements of a given block are disabled, Unidex 11 flashes a "Memory Altered" warning and performs a Memory Repair routine on the accessed program (see Program Editing Malfunction, section 5-1).

If nn is a new program, pressing ENTER will display:

End of Program

This means there is presently no data within this program. Press INSERT to view the available choices of blocks. You may choose from 7 different edit menu screens by pressing SELECT.

All edit blocks to be entered into the program are accessed by pressing keys within these menus. The 7 edit screens are shown on the following pages. The edit mode has many subdivisions which must be explained in detail. Therefore, chapter 3 is dedicated to describing the edit mode.

NOTE: Anytime you wish to exit the edit mode, press **INSERT** and then **BACK**. You will return to the fourth main screen.

FIRST EDIT SCREEN

1. INDEX	3. HOME
2. DWELL	4. GET BLOCK

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SECOND EDIT SCREEN

1. OUTPUT	3. OUT/STOP
2. INPUT	4. OUT/RUN

THIRD EDIT SCREEN

1. STRT RPT	3. COND RPT
2. END RPT	4. PGM RPT

FOURTH EDIT SCREEN

1. START AXIS	3. LOAD REG
2. STOP AXIS	4. INC/ABS

FIFTH EDIT SCREEN

1. LABEL	3. SUB RTN
2. BEEP	4. PROG STOP

SIXTH EDIT SCREEN

1. GOTO	3. COND.GOTO
2. GOSUB	4. COND.GOSUB

SEVENTH EDIT SCREEN

1. COR RND	3. ACL/DCL
2. PROG DEL	4. DIG OUT

You can make a choice from any of these screens and enter the appropriate data, pressing ENTER to insert a block into the program.

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To view program blocks, press ENTER to step forward and BACK to step backwards. DELETE will delete a block and INSERT will bring you to the first edit screen.

When in any of the edit screens, press INSERT and BACK to go back to the fourth screen.

O. DIRECTORY

Press key #2, DIRECTORY, to see:

1. DIRECTORY	3. LOAD DFLT
2. TEST MEM	7. CLEAR MEM

NOTE: CLEAR MEM is given a number 7 instead of 4 so that the user will not inadvertently press 4 instead of 2 for TEST MEM and clear the entire memory.

1. DIRECTORY

Press key #1, DIRECTORY, to see:

DIRECTORY LISTING
SELECT: list BACK: quit

SELECT will give you the list of your programs. For example:

02, 05, 10
end

In the above example, the directory contains 3 programs. If there are more than 10 programs in memory, you will see:

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02, 05, 10, 12, 13, 15,
22, 25, 30, 21, more

Press SELECT to see successive pages. The last page will say "End" instead of "More".

Press BACK to return to the fourth main screen.

2. *TEST MEMORY*

In the directory screen, press key #2, TEST MEM, to test your memory. It will test the memory and give you the amount of bytes free. Example:

Tested & Saved Memory
Free: 06048 BYTES

Press BACK to return to the fourth main screen.

3. *LOAD DEFAULT*

Press key #3. You will :

DEFAULT VALUES LOADED
Press BACK to quit

The Load Default function loads the default values back into user's memory from Unidex 11.

After changing values, re-entering the default values can be accomplished with this one function, rather than re-entering the values one at a time.

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The default values for all axes are:

Run Speed	10,000 units/second
Jog Speed	10,000 units/sec
Jog Increment	10,000 units
Joystick Divisor	20
Joystick Program	1
Outputs	Active Low
Free-run Axis	Will not stop on feedhold, key#3 (soft stop) or limits.

Where units = mm, microns, etc. (including fractions of units).

If your system does not have battery-backed memory, Unidex 11 always reverts to the original default values upon powering up.

Press BACK to return to the fourth main screen.

4. *CLEAR MEMORY (labeled key #7)*

Press key #7, CLEAR MEM, to see:

DELETE: clear memory
BACK: quit

Press BACK to return to the directory screen.

Press DELETE to see:

Tested & Cleared Memory
Free: 06048 BYTES

Press BACK to return to the fourth main screen.

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P. PROGRAM RUN - BLOCK RUN MODE

In the fourth screen, BLOCK RUN is one of the Program Run modes.

Press key #3, BLOCK RUN, of the main menu's fourth screen to see:

Input Program #
00

Enter the program number and press ENTER. (You must enter a program number before you are given the choice to RUN or BACK, as shown below. You cannot exit this mode in any other fashion.) You will see:

RUN: Start exec. Block
(Press BACK to quit)

RUN will execute the first block of the program. Successively pressing RUN will execute the program one block at at time.

When executing a program in the Block Run Mode, a "b" will appear on the display in the left-hand column beside each axis. This indicates the Block Run Mode. Press RUN to execute the first block of program. A "c" will appear in the left-hand column, indicating "continue". Press RUN to execute each subsequent block. When the final block has completed, a "d" will appear in the left-hand column, indicating "done". Press RUN to start the program again. Press BACK to re-enter the fourth main screen.

Q. PROGRAM RUN - AUTO MODE

Auto mode is the other Program Run mode.

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Press key #4 to execute a program in the auto mode. You will see:

Input Program #
00

Enter the program number and press ENTER. (You must enter a program number before you are given the choice to RUN or BACK, as shown below. You cannot exit this mode in any other fashion.) You will see:

RUN: Start exec. Auto
(Press BACK to quit)

Press RUN to execute the program from start to end. Once the program run is complete, press BACK to re-enter the fourth main menu.

The soft stop (#3) key may be used to stop program execution. Press RUN to continue the program.

The STOP key will stop the program and display the position registers. Press BACK to re-enter the fourth main screen.

If an axis is free-running when a Program Run (either Block Run or Auto Run) is requested, the following warning will be displayed:

WARNING Axes in motion
ENTER: continue BACK: quit

Press ENTER to see:

Input Program #
nn

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If the program title contains the number 9, which necessitates pressing the #9 (STOP) key, the free-run will be aborted.

When in the Auto mode and running a program, press SELECT to switch to the Block mode. The program will halt at the end of the current block. Now RUN may be pressed to execute the next block. To return to the Auto mode, press SELECT again and then RUN to start execution.

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CHAPTER 3: THE EDIT MODE

Many program blocks within the edit mode operate in the same manner as those described in chapter 2, *Modes of Operation*.

SECTION 3-1 FIRST EDIT SCREEN

In the fourth main screen, press EDIT. Input a program number (01 - 99) and press ENTER twice. Entering the number of a new program and pressing ENTER twice, will bring up the End of Program block. Entering the number of an existing program and pressing ENTER twice, will cause the first block of the program to be displayed. (Repeatedly pressing ENTER will display the subsequent blocks.) Pressing INSERT will bring up the first edit screen (shown below). Press SELECT for further edit screens.

FIRST EDIT SCREEN

1. INDEX	3. HOME
2. DWELL	4. GET BLOCK

NOTE: When editing a program, pressing INSERT brings up the first edit screen (shown above). Pressing SELECT will display the edit screens (7 in all) discussed in this chapter. If you select one of these edit functions by pressing the appropriate key number, it is entered into your program and the next program block is displayed. If, however, you decide not to enter an edit function once INSERT has been pressed, press INSERT again to return to the program block and resume editing.

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A. INDEX

Press key #1, INDEX, for the same screen as listed in section 2-2 D. All data entry is identical to that listed in that section. If you are editing an existing index block, and want to delete all data pertaining to an axis within that block, SELECT the axis by pressing any of the two arrow keys relevant to it. When that axis is flashing on the display, press DELETE to erase that entire line, if desired. When the F (feedrate) or D (distance) is flashing, pressing DELETE will erase only the information pertaining to that particular function. Once you begin to enter data, pressing DELETE will delete only the last digit entered.

WARNING: When a new block is displayed, pressing DELETE will delete the entire block from memory and bring up the next block.

After all indexing data is entered in this program block, pressing ENTER will enter the block into the users memory and the display will either show "END OF PROGRAM" or the next block. Press INSERT if another program block is to be inserted. The first edit screen will be displayed again.

B. DWELL

In the first Edit screen, pressing key #2 will display:

Dwell 000.0 Seconds

You may choose a dwell ranging from .1 to 499.9 seconds. Press ENTER to enter a dwell into the program. The "end of program" message will be displayed if that was the last block in the program, or the next program block will be displayed if editing an existing program.

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Press INSERT to enter the next program block. The first Edit Screen will be displayed again. (If you need to see subsequent blocks, press SELECT.)

C. HOME

In the first edit screen, press key #3 for Home. You will see:

Go Home (+/- & Select)
X: n Y: n U: n V: n

The X axis will be flashing. Press the +/- to toggle between n (no) and y (yes). Press the SELECT key to skip to the next axis, and eventually loop around to X again. After home data has been entered, press ENTER and then INSERT to see the first Edit screen.

D. GET BLOCK

In the first Edit screen, pressing key #4, Get Block, will display:

Go To Block #
000

Entering a number from 1 to 999 will let the program jump, while editing, to the block number specified.

For example, when editing a program, if you wish to skip to the 50th block, use the Get Block command to jump to block 50, rather than press ENTER 50 times. Or if, as mentioned in part A of this section, you are in the edit screens, but have not selected an edit function from them, the GET BLOCK function allows you to re-enter the program.

This is strictly an edit function and is not for program execution purposes.

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NOTE: It is the responsibility of the programmer to keep track of block numbers when using this function. Block numbers are not displayed on the screen.

Press INSERT to insert a space for a new block directly *before* the Get Block number selected. The first edit screen will now be visible. Choose a block from this screen or press SELECT to view subsequent edit screens. Assume that at this point, however, you decide *not* to insert a new block in this space. If this is the case, pressing INSERT will cancel the "new" block space. You will then see the original block accessed by the Get Block command (i.e., an INSERT can always be cancelled by pressing a subsequent INSERT).

SECTION 3-2 SECOND EDIT SCREEN

When in the first Edit screen, press SELECT to see the second Edit screen.

SECOND EDIT SCREEN

1. OUTPUT 3. OUT/STOP
2. INPUT 4. OUT/RUN

A. OUTPUT

In the second Edit screen, press key #1, Output, to see:

Output (0, 1, X & Select)
O1: X O2: X O3: X O4: X

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This function allows the output to be programmed as a 1, a 0 or a "don't care" (X). In this case "don't care" means don't change from previously set value.

When an axis is flashing on the display, enter 1, 0 or X (key 7 or 8), or just skip to the next axis by pressing SELECT.

Press ENTER to enter output data. Then press INSERT and SELECT to see the second Edit screen.

B. INPUT

In the second Edit screen, press key #2, Input, to see:

Input (0, 1, X & Select)
I1: X I2: X I3: X I4: X

This allows the program to wait until the input conditions match what is programmed.

The programming of an input is the same as that of an output, previously discussed in section 3-2 A.

Press ENTER to enter input data. Then press INSERT and SELECT to get to the 2nd screen of edit functions again.

NOTE: For information regarding the connections to the DIO Port, refer to the *Unidex 11 Motion Controller Hardware Manual*.

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C. OUT/STOP

In the second edit screen, press key #3, Out/Stop, to see:

Out/Stop (1, 0, X & Select)
O1: X O2: X O3: X O4: X

The purpose of this function is to program what condition will be output (0, 1 or don't care) when the program is stopped, either via the STOP key or a feedhold.

The method of programming the Out/Stop function is the same as in the two previous subsections, 3-2 A and B.

As before, press ENTER to enter OUT/STOP data. Then press INSERT and SELECT to see the 2nd screen of edit functions.

D. OUT/RUN

In the second Edit screen, press key #4, OUT/RUN, to see:

Out/Run (1, 0, X & Select)
O1: X O2: X O3: X O4: X

The purpose of this function is to program what will be output (0, 1 or don't care) when the program is restarted after a *stop* operation. Restart could exist as a result of the feedhold or pressing the RUN key. Press ENTER to enter Out/Run data. Press INSERT and then SELECT two times to see the third Edit screen.

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SECTION 3-3 THIRD EDIT SCREEN

THIRD EDIT SCREEN

1. STRT RPT	3. COND RPT
2. END RPT	4. PGM RPT

A. START REPEAT

In the third Edit screen, press key #1, STRT RPT, to see:

Repeat Loop Start
Repeat 0000 Times

The number of times the command blocks within the repeat loop are to be executed may be entered through the above program block.

Press ENTER once you have selected the number desired. Press INSERT and then SELECT two times to see the third Edit screen.

B. END REPEAT

In the third Edit screen, press key #2, END RPT, to see:

Repeat Loop End
Press Enter

The End Repeat command block is placed after all command blocks to be included in the repeat loop.

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Press ENTER to enter the END RPT command. Press INSERT and then SELECT two times to see the third Edit screen.

C. CONDITIONAL REPEAT

In the third Edit screen, press key #3, COND RPT, to see:

Cond Rpt (0, 1, X & Enter)
I1: X I2: X I3: X I4: X

The Conditional Repeat command can be placed at the end of a repeat loop instead of an End Repeat command.

When Cond Rpt ends the repeat loop, the condition of the inputs dictates whether the commands will be repeated or not. If the conditions specified within the Cond Rpt command are true, the loop ends. If any of the conditions are false, the loop will repeat again.

This cycle will continue until one of two things happens:

1. The input conditions are met.

2. The number of loops specified by the STRT RPT command is completed.

The input conditions of the COND RPT command are entered as specified in section 3-2.

Press ENTER once you have selected the number desired. Press INSERT and then SELECT two times to see the third Edit screen.

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D. PROGRAM REPEAT

In the third Edit screen, press key #4, PGM RPT, to see:

Program Repeat
Press Enter

This function will cause the entire program to repeat. Remember that any program blocks entered after PGM RPT will not be executed.

Press ENTER. Press INSERT and then SELECT three times to see the fourth Edit screen.

SECTION 3-4 FOURTH EDIT SCREEN

FOURTH EDIT SCREEN

1. STRT AXIS 3. LOAD REG
2. STOP AXIS 4. INC/ABS

A. START AXIS

In the fourth Edit screen, press key #1, STRT AXIS, to see:

Strt Free Run Axis (+/-)
X: n Y: n U: n V: n

Press +/- to change the X axis free-run status (n for no and y for yes). To move to the Y axis selection, press SELECT and press ENTER. Once you've entered your free-run axis information, press INSERT and then SELECT (3 times) to see the fourth edit screen

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again. A free-running axis that has been stopped with a Stop Axis command may be restarted with the Start Axis command.

B. STOP AXIS

In the fourth Edit screen, press key #2, STOP AXIS, to see:

Stop Free Run Axis (+/-)
X: n Y: n U: n V: n

This function stops a free-running axis. Press ENTER, INSERT and then SELECT three times to see the fourth Edit screen.

C. LOAD REGISTER

In the fourth screen, press key #3, LOAD REGISTER, to see:

Load X:
Load Y:

Press the appropriate axis key. The axis will begin to flash on the display. You may now enter the Absolute Position Register data. Press DELETE if the previous number is to be erased. Press ENTER to enter axes values, and press ENTER again when data is complete.

The position set via this command may be used to establish a temporary reference point, when using the absolute mode.

Press ENTER, INSERT and then SELECT three times to see the fourth Edit screen.

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D. INCREMENTAL/ABSOLUTE

In the fourth Edit screen, press key #4, INC/ABS, to see:

Inc/Abs (+/- & Enter)
INCREMENTAL

The +/- key toggles between the Incremental and Absolute modes.

Absolute mode measures an absolute distance, i.e., distance referenced from X0, Y0, U0 and V0 (U0 and V0 apply to 4-axis chassis).

In the incremental mode, distance is referenced from the present position of the axes, not from the initial start position.

The Incremental/Absolute command is modal. Once it has been changed by a program, it remains in the current mode until it is changed again.

Press ENTER, INSERT and the SELECT four times to see the fifth Edit screen.

SECTION 3-5 FIFTH EDIT SCREEN

FIFTH EDIT SCREEN

1. LABEL	3. SUB RTN
2. BEEP	4. PROG STOP

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A. LABEL

In the fifth Edit screen, press key #1, LABEL, to see:

Enter Label #
00

This allows you to enter a label (0 to 99) into the program which serves as a subroutine name for a GOSUB command or as an entry point for a GOTO command. When calling for a subroutine or a jump, call for a label number which corresponds to that label given to the subroutine or entry point via the above command.

Press ENTER, INSERT and then SELECT four times to see the fifth Edit screen.

B. BEEP

Press key #2, BEEP, to see:

Set Beep (+/- & Enter)
BEEP OFF

Press +/- to toggle between BEEP OFF and BEEP ON. Press ENTER.

BEEP ON turns on the buzzer in Unidex 11. BEEP OFF turns it off. Once the beep is turned on, it will stay on until a BEEP OFF block in the program is encountered.

Press ENTER, INSERT and then SELECT four times to see the fifth Edit screen.

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C. SUBROUTINE RETURN

In the fifth Edit screen, press #3, SUB RTN, to see:

Return From Subroutine
Press Enter

Press ENTER to enter this program block into the program. This command is placed at the end of a subroutine. It causes program flow to return to the block immediately following the GOSUB block that called the subroutine.

Press INSERT and then SELECT four times to see the fifth Edit screen.

D. PROGRAM STOP

In the fifth Edit screen, press key #4, PROG STOP, to see:

Program Stop
Press Enter

This command block causes program execution to stop and returns control to the operator keyboard.

Subroutines are generally placed after the Program Stop command, although it is not necessary to provide a program stop in a program.

Press ENTER, INSERT and then SELECT five times to see the sixth Edit screen.

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SECTION 3-6 SIXTH EDIT SCREEN

SIXTH EDIT SCREEN

1. GOTO	3. COND.GOTO
2. GOSUB	4. COND.GOSUB

A. GO TO

In the sixth Edit screen, press key #1, GOTO, to see:

GOTO Label #
00

This command will send the program to the entry point identified by the corresponding label "nn" (see section 3-5 A).

Enter the number, press ENTER, INSERT and then SELECT five times to see the sixth Edit screen.

B. GO SUB

In the sixth Edit screen, press key #2, GOSUB, to see:

GOSUB Label #
00

This command directs program flow to the subroutine identified by the corresponding label "nn" (see section 3-5 A). Remember, subroutines may be entered after a Program Stop command and every

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subroutine should have a SUB RTN command at the end. (See section 3-5, C.)

Enter number, press ENTER, INSERT and then SELECT five times to see the sixth Edit screen.

C. CONDITIONAL GO TO

In the sixth Edit screen, press key #3 to see:

GOTO: 00 If Input Is =
I1: X I2: X I3: X I4: X

Enter the block number and then press SELECT to see:

GOTO: 00 If Input Is =
I1: X I2: X I3: X I4: X

Enter for I1 through I4, 1, 0 or X (key 7 or 8). Use SELECT to move the cursor from I1 to I4.

The conditional GOTO is the same as the previously described GOTO in that "nn" identifies the entry point to which the program must jump. In the case of the conditional GOTO, however, the jump occurs only if the conditions of the inputs set in the above command are satisfied. Otherwise, the program continues with the next block.

Press ENTER, INSERT and then SELECT five times to see the sixth Edit screen.

D. CONDITIONAL GO SUB

In the sixth screen, press #4 key, COND.GOSUB, to see:

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GOSUB: 00 If Input Is =
I1: X I2: X I3: X I: X

This command functions in the same fashion as the Conditional GO TO, above. The label nn identifies the subroutine of the same name. The program can only go to the subroutine labeled "nn" if the input conditions specified in the above command are satisfied.

After entering data, press ENTER, INSERT and then SELECT six times to see the seventh and final edit screen.

SECTION 3-7 SEVENTH EDIT SCREEN

SEVENTH EDIT SCREEN

1. COR RND	3. ACL/DCL
2. PROG DEL	4. DIG OUT

A. COR RND

In the seventh Edit screen, press key #1, COR RND, to see:

Corner Rnd (+/- & Enter)
NON CORNER ROUNDING

The +/- key allows Unidex 11 to toggle between corner rounding and non-corner rounding.

In the corner-rounding mode, Unidex 11 does not wait for the "in-position" signal to come in from the amplifier before beginning the next move.

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With non-corner rounding, however, Unidex 11 does wait for the "in-position" signal to come in before continuing on with the next move.

WARNING: This mode is recommended only for closed loop DC Servo control. Used with open loop stepping control, this mode may cause positioning errors.

Press ENTER, INSERT and then SELECT six times to see the seventh screen.

B. DELETE PROGRAM

In the seventh screen, press key #2, PROG DEL, to see:

Enter Prog to be Deleted
00

Enter a program number from 01 - 99 here. This command will delete the entire program.

Press ENTER and then INSERT to see the first Edit screen again.

C. ACCEL/DECEL AND DIGITAL OUTPUT

These functions are associated with the programmable Accel/Decel and Digital I/O Port options. Refer to Part III of this manual, *Programming Accel/Decel for the Unidex 11*, for more information on acceleration and deceleration control. Refer to the *Unidex 11 Motion Controller Options Manual*, for more information on the Digital Output Port (DIO) Option.

To get back to one of the four main menu screens from any of the Edit screens, use one of the two techniques below:

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1. Press BACK as many times as necessary until the first Edit screen is shown. Pressing back one more time will show the fourth main menu screen.

2. Press SELECT as many times as necessary until the display "rolls around" to the first Edit screen. Pressing BACK will show the fourth main menu screen.

NOTE: When scanning the seven Edit screens while editing a program, use the SELECT key to roll through the screens. The display will scan up to the seventh edit screen and then "roll" back to the first edit scanners automatically. Using the BACK key will scan the Edit screens from the seventh to the first. However, when the first edit screen is reached, pushing the BACK key one more time will put the display in the fourth main menu screen (and out of the edit mode).

A sample program is provided in Appendix 1 of Part II of this manual. It is recommended that you follow through with this example on the Unidex 11 before attempting to write your own program.

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CHAPTER 4: TROUBLESHOOTING

Section 4-1 lists possible malfunctions for software power-up, program editing and manual program run modes.

SECTION 4-1 SOFTWARE MALFUNCTIONS

POWER UP:

MESSAGE	POSSIBLE CAUSE AND SOLUTION
System Check Fail: System RAM Rd/Wrt Error	A system RAM READ/WRITE error is caused by a memory byte failure somewhere within the 8K RAM chip M3 on the control board (CB4). On power-up, Unidex 11 checks all byte locations of the RAM by writing a value back for verification. For the battery back-up option, only the area dedicated to system RAM is checked in this manner. The user area (program area) is not tested. The user can, however, test the program area even with battery back-up (refer to item O of section 2-2, Test Memory). For this test, Unidex 11 will temporarily store each program byte of the program area in a register, check the given program memory byte, and return the original information from the register to the memory byte again.

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Refer to *Unidex 11 Motion Controller Hardware Manual* for information on replacing RAM chips M3 or M11.

System Check: Fail User Memory Checksum Error

A check sum verification is performed on the RAM upon power-up. *This is performed only on the battery back-up memory option.*

At the end of program editing or manual mode parameter changes (i.e., joystick divisor, slew speed parameters, etc.) Unidex 11 modifies the check sum register. When Unidex 11 is powered up again, a sum of all bytes in the RAM (M3 on the CB4 Control Board or M11 on the OP4 Option Board) is made (see *Unidex 11 Motion Controller Hardware Manual*). This sum is then compared to the check sum register. If they do not match, one or more bytes in RAM has been altered.

Note that a check sum error may not necessarily mean a damaged RAM. In some instances, battery backed RAM may be altered by a system software malfunction or a power failure during editing.

System Check: Fail Control Board Rom Error

Unidex 11 also does a check sum verification on the system ROM itself. Even though the ROM cannot be altered by a software error, there is still the possibility that one of the ROM memory locations can become faulty due to some electrical malfunction. The procedure for performing this test is similar to that of the user memory (RAM) check sum described above.

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This test is done only on the CB4, Control Board ROM. The ROM chip number is M2.

System Check: Fail Option Board ROM Error

A checksum is also performed on the system ROM of the OP4 option board (optional).

The test is similar to the ROM checksum test of the CB4 control board described above, except ROM chip M3 of the OP4 option board is tested. (Refer to *Unidex 11 Motion Controller Hardware Manual* for more information.)

PROGRAM EDITING:

MESSAGE	POSSIBLE CAUSE AND SOLUTION
WARNING: AT END Of MEM Press ENTER to Continue	An End of Memory warning statement alerts the user that the next block of instruction(s) to be entered may not be stored, because available program memory space is almost depleted. If this situation occurs, the programmer should either reevaluate the program being written for better coding efficiency, or go back to the program delete mode (item B, section 3-7) to delete the existing programs, allowing more space for the new program being written.

NOTE: If the RS-232 option exists, before being deleted, programs can be downloaded into a storage device. (See Part IV of this manual, *RS-232 Serial Interface Programming of the Unidex 11,* for more information.)

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BLK NOT SAVED, MEM FULL Press ENTER to Continue

If an attempt to enter an additional block of statement(s) is made after an End of Memory warning (described above) is encountered, and the block size is larger than the available remaining memory space, a "Block Not Saved" statement will appear. Note some block sizes are larger than others, depending on the statement(s) being entered. So it is possible that small blocks (such as "Go To", "Go Sub", etc.) may be entered without being truncated.

If the Memory Full warning is encountered after entering a block which exceeds the amount of memory available, the block will be ignored.

MEMORY ALTERED Press SELECT to Continue

When an existing program is accessed in the edit mode, Unidex 11 performs a checksum on the entire contents of that program.

Unidex 11 also evaluates the statements of each program block as they are pulled for editing purposes. Each statement is analyzed for the proper format.

If in either of the two cases above, a "Memory Altered" statement appears. Unidex 11 automatically performs a "Memory Repair" on the program which has been accessed. If undefined statements of a given block of the program are encountered, the entire block containing the statement(s) is deleted.

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What is left is a program with missing blocks. The user need only scan this program and replace the missing blocks.

Memory Repair is a very important feature because it eliminates the possibility of Unidex 11 "locking up" if a faulty program is executed. Remember, since Unidex 11 is menu driven, the possibility of entering improper data is next to impossible. A "Memory Altered" warning can only exist due to faulty RAM or some unrecoverable transient power glitch on the input power supply. In both cases the occurrence is rare.

MANUAL/AUTO RUN:

MESSAGE	POSSIBLE CAUSE
ILLEGAL BYTE IN MEMORY Press BACK to quit	If during manual or program execution, a user memory byte cannot be identified by Unidex 11, an illegal byte in memory statement will appear. This detection mechanism monitors on a block by block basis, unlike the checksum and block verification mechanisms described in the previous sections on Power Up and the Editing Mode. These mechanisms "scanned" the entire user memory before execution took place. For this error detection mode, "BACK" functions as an escape, allowing the Unidex 11 to return to the main menu screens.

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Exceeded 8 Repeat Loops

Unidex 11 programming mode allows only a maximum of eight "nested" repeat loops. (i.e., a loop within a loop, eight times). A possible user-stack overload condition exists if the level of loop nesting exceeds eight levels.

Remember, an unlimited amount of unnested repeat loops are allowed.

The "Exceeded 8 Repeat Loops" error is detected during program execution.

Invalid Repeat-Loop End

This statement declares that a repeat loop "End Repeat" statement was encountered without a preceding "Start Repeat" statement.

This error is detected during program execution.

Incompleted Repeat Loops

This statement declares that a "Start Repeat" statement was encountered without a following "End Repeat" statement.

This error is detected at the end of program execution.

Incomplete Subroutines

This error statement is similar to a "Incomplete Repeat Loop" error statement in that a "Go Sub" statement was detected without a following "Return-from-Sub" statement.

This error is detected at the end of program execution.

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Missing Label

This statement declares that a program label does not exist for a label number specified in a given "GoTo", "GoSub", "Cond. GoTo" or "Cond.GoSub" statement.

This error is detected during program execution.

Exceeded 8 Subroutines

This error statement is similar to an "Exceeded 8 Repeat Loops" error statement in that a maximum number of 8 "nested" subroutines has been exceeded.

A possible user stack overload exists if the level of subroutine nesting exceeds eight levels.

Remember, up to 99 unnested subroutines are allowed (i.e., up to 99 available program labels).

This problem is detected during program execution.

Invalid Return-from-Sub

This statement declares that a "Subroutine Return" statement exists without a corresponding "GoSub" statement.

This error is detected during program execution.

Memory Checksum Error

Unidex 11 evokes a checksum test on user program memory when an auto or block program run is activated by the RUN key (see item P and Q of section 2-2).

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	Checksum errors are attributed to causes discussed in the "Power Up" and "Program Editing" error statements discussed in a previous part of this section (section 4-1).
No Programs In Memory	This statement declares that no programs exist in user memory as dictated by the directory command (part 1, item O of section 2-2).
Invalid Program #nn Press BACK to Quit	This statement declares that the program number (specified by "nn") does not exist in user memory as specified by item Q, section 2-2.
X Axis In Limit, Y Axis In Limit, U Axis In Limit, V Axis In Limit	If an X, Y, U and/or V axis CW or CCW limit is encountered during manual, block or auto run modes, an "AXIS IN LIMIT" warning statement will appear. If this occurs in the manual mode, the user need only press the "arrow" key to move the axis out of the given limit. In the block or auto run modes, the user must go to the manual mode (slew or jog) and move the given axis out of the limit.
***WARNING* Axis In Motion ENTER: Continue BACK: Quit**	See item Q, section 2-2 for information regarding this warning statement.

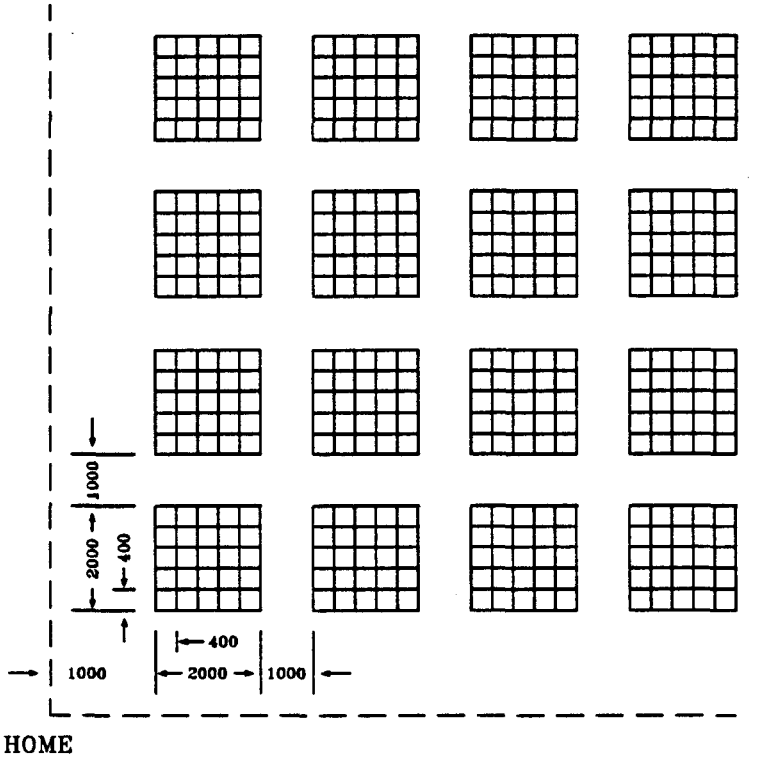
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APPENDIX 1: PROGRAMMING EXAMPLE FOR UNIDEX 11

A. X/Y SCANNER

The sample given is a simple X/Y scan type program, where X and Y axes are moved to form a scan running parallel to the X axis, and then an overlapping scan running parallel to the Y axis. The above pattern is then repeated three more times along a row. Now the entire row is repeated 3 more times to form a 4 x 4 matrix of the patterns. Output O1 drives a pen down to draw required parts of the pattern. After each pattern the beeper is turned on for one second. The pen operation as well as beeper is in subroutine form. The basic moves of the scan also are in subroutine. The axes are first sent home at the start of the program.

The program should draw the following pattern:



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The program logic may be described as follows:

```
1. Go Home  X:Y                          ; send axis home
2. Incremental mode                      ; set incremental mode
3. Non Corner Rounding Mode              ; set non-corner rounding mode
4. Index  X F1000 D1000                  ; offset to start scan
          Y F1000 D1000                  ; Y move
5. Start Repeat Loop : 4 times           ; pattern column repeat
6. Start Repeat Loop : 4 times           ; pattern row repeat
7. GOSUB Label #10                       ; scan pattern subroutine
8. End Repeat Loop                       ; End of row repeat
9. Index  X F1000 D-12000                ; offset to start next
Y F1000 D 03000                          ; pattern
10. End Repeat Loop                      ; end of column repeat
11. Program stop                         ; end of program execution
12. Label #10                            ; main subroutine start
13. Start Repeat Loop : 3 times          ; X parallel scan start
14. GOSUB Label #20                      ; X parallel scan moves
15. End Repeat Loop                      ; end of repeat
16. Index X                              ; no X move
Y F1000 D-0400                           ; position for Y scan
17. Start Repeat Loop : 3 times          ; Y parallel scan start
18. GOSUB Label #30                      ; moves
19. End Repeat Loop                      ; end of loop
20.  Index  X F1000  D 0600              ; position for next pattern (X move)
          Y F1000  D-2000                ; Y move
21. GOSUB Label #15                      ; BEEP ON for 1 sec.
22. Return from Subroutine               ; return from Sub #10
23. Label #20                            ; X scan moves
24. GOSUB Label #51                      ; pen down
25. Index  X F1000 D02000                ; X move
          Y                              ; No Y move
26. GOSUB Label #52                      ; pen up
27. Index X                              ; No X move
          Y F1000 D00400                 ; Y move
28. GOSUB Label #51                      ; pen down
29. Index X F1000 D-2000                 ; move X
          Y                              no Y move
30. GOSUB Label #52                      ; pen up
31. Index X                              ; no X move
          Y F1000 D00400                 ; Y move
```


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```
32. Return from Subroutine              ; ends X scan moves
33. Label #30                           ; Y scan moves
34. GOSUB Label #51                     ; pen down
35. Index X
          Y F1000 D-02000               ; Y move
36. GOSUB Label #52                     ; pen up
37. Index  X F1000 D00400
          Y
38. GOSUB Label #51                     ; pen down
39. Index X
          Y F1000 D02000
40. GOSUB Label #52                     ; pen up
41. Index  X F1000 D00400
          Y
42. Return from subroutine              ; ends Y scan move
43. Label #15                           ; 1 second beeper
44. Beep ON                             ;
45. Dwell 001.0 seconds
46. Beep OFF
47. Return from subroutine
48. Label #51                           ; pen down
49. OUTPUT  O1:1  O2:X  O3:X  O4:X      ; activate relay
50. Dwell 000.1 seconds                 ; delay for relay
51. Return from Subroutine
52. Label #52                           ; pen up
53. OUTPUT  O1:0  O2:X  O3:X O4:X       ; deactivate relay
54. Dwell 000.1 seconds                 ; delay for relay
55. Return from subroutine
```

The actual key strokes for part of the program are presented on the following pages.

Power up Unidex 11. Press SELECT 4 times

The FOURTH SCREEN is now displayed. Press #2. You now see:

1. DIRECTORY 3. LOAD DFLT
2. TEST MEM 7. CLEAR MEM

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Press #7. You will see:

DELETE: clear memory BACK: quit

Press DELETE and then press BACK. You are back in the FOURTH SCREEN.

Press #1. Unidex 11 now requires a program number, say 25. Press #2, #5, ENTER.

You now see:

End of Program

Press INSERT. You now have the FIRST EDIT SCREEN

Press #3. You have the GO HOME screen.

Press +/- to program X axis to go home. Press SELECT to see Y flashing. Press +/- to program Y axis go home.

Press ENTER to enter this block in memory. You now see:

End of Program

Press INSERT. Press SELECT 3 times. You now see the FOURTH EDIT SCREEN. Press #4. Press ENTER to enter the Incremental mode command block into memory.

Press INSERT. Press SELECT 6 times. Press #1. Press ENTER to program non corner rounding.

Press INSERT. Press #1 for the INDEX SCREEN.

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Press any X key, press ENTER. The F next to X is flashing on and off. Enter the required feedrate: #1, #0, #0, #0, ENTER. Now enter a distance offset from home #1, #0, #0, #0, ENTER.

Press any Y key, press ENTER. Enter same feedrate and distance for Y in the same manner as for X.

Press ENTER to enter the block into memory. Press INSERT. Press SELECT 2 times. Press #1. Press #4, ENTER. The first repeat loop is now initiated.

The rest of the program may be similarly entered, referring to the logic described previously.

After entering the entire program, press INSERT, BACK to quit the editor and to see the FOURTH SCREEN.

Press #4 (AUTO RUN). Press #2, #5 to enter program number you want to run. Press ENTER. Press RUN to start program execution.

While the program is running, the STOP key may be pressed to stop program execution. Press key #3 to pause program execution. Press RUN to continue.

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PART III

PROGRAMMABLE ACCELERATION/DECELERATION FOR THE UNIDEX 11

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CHAPTER 1: PROGRAMMABLE ACCEL/ DECEL

Programmable Acceleration/Deceleration increases the performance of the motion control system by providing the ability to achieve higher motor speeds. The ramp time (the time to attain programmed feedrate) is programmable from 10 milliseconds to 4999 milliseconds. The acceleration/deceleration profile may be set up to be linear or parabolic. Also programmable is the individual start/stop feedrate for each axis. (The start/stop setting is used as a default speed for very short moves where accel/decel can not be used, and also as the starting and ending speed when implementing accel/decel.)

Once the user has set (Set Up mode) the desired ramp time, start/stop feedrate and the profile for acceleration/deceleration, the values are stored in the battery backed up memory. The system default values for these parameters are:

ACCEL/DECEL RAMP TIME: 250 MILLISECONDS
START/STOP FEEDRATE: 500 STEPS/SECOND
ACCEL/DECEL PROFILE: LINEAR

These parameters are modal. That is, they stay in effect in both the programmed (indexed) and immediate modes of Unidex 11. However, Unidex 11 can be programmed (in the edit mode) to change the accel/decel ramp time during program execution. (Start/stop feedrate and accel/decel profile can only be changed in the Set Up mode.) If the accel/decel ramp time is changed during program control, the last value set becomes the new modal accel/decel parameter.

Before proceeding with the discussion of the accel/decel option, it is assumed that the user has reviewed Part II (*Menu-drive Front Panel Programming*) of this manual.

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CHAPTER 2: PROGRAMMING ACCEL/DECEL

SECTION 2-1 MANUAL PROGRAMMING OF RAMP TIME

To program the parameters related to acceleration and deceleration, bring up the fifth screen of the main menu:

1. DIG. OUT	3. COMM ENAB
2. ACL/DCL	4. PRINT

Press key #2 to see:

1. ACCEL/DECEL RAMP TIME
2. START/STOP SPEED ENTRY

Press key #1 to select ramp time programming:

ENTER ACL/DCL RAMP TIME
0250 msec

The screen shows the current active value of ramp time.

The required ramp time may now be programmed. This value may be from 10 to 4999. Any value below 10 will be entered in the system as zero and this will turn acceleration and deceleration OFF. After entering the ramp time, press "ENTER". Unidex 11 now gives you the option to execute the command by pressing RUN or to quit by pressing BACK (as described in the command description in Part II, chapter 2 of this manual).

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User memory (battery back up) will be updated as a result of manually programming the ramp time.

SECTION 2-2 PROGRAMMING START/STOP FEEDRATE

The start/stop speed entry is similar to Run speed entry. Press key #2 to select start/stop speed programming.

SS-Spd X 0000500 step/s
SS-Spd Y 0000500 step/s

Feedrate values from 1 to 999,999 units/sec may be entered here (in this case, 0 to 999,999 steps/sec). Start/stop speed is the speed the axis defaults to when a programmed move is too short to implement acceleration and deceleration. If the time for the move is less than 10 milliseconds, acceleration/ deceleration is turned off for the move and the move is executed at the start/stop feedrate.

SECTION 2-3 ACCEL/DECEL PROFILE SETUP

The accel/decel profile is set up as linear or parabolic using the Set Up screens (see section 2-2 K of Part II of this manual). The Set Up screen, immediately after the Digital Input/output screen, shows:

Programmable Accel/Decel
Profile : LINEAR

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Press +/- to change the set up to PARABOLIC. Press SELECT repeatedly until the system goes back to the main menu screens.

SECTION 2-4 RAMP TIME PROGRAMMING

The seventh EDIT screen (see Part II of this manual) allows acceleration/deceleration ramp time programming.

1. COR RND	3. ACL / DCL
2. PROG DEL	4. DIG. OUT

Press key #3 for:

ENTER ACL/DCL RAMP TIME
0000 msec

Now enter the required value and press ENTER to enter the block in memory. The accel/decel block, if called up again, will show the most recently entered ramp time.

To turn off acceleration/deceleration, program 0 milliseconds.

The motion command for entering the ramp time when downloading a program via a communication port (i.e., RS-232C or IEEE-488) is:

AD nnnn *

where "nnnn" is the ramp time in milliseconds. (See Part IV of this manual for information on RS-232C and the *Unidex 11 Motion Controller Options Manual* for information on IEEE- 488.)

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The ramp time may be programmed as many times as required within a program. At the end of program execution, the value of the ramp time will remain as the last programmed value. If programmed manually before running a program, this value will be effective at the start of the program. The last ramp-time block executed from a program becomes modal to the system, but is *not* retained in the battery backed user memory after power down.

SECTION 2-5 WHEN ACCEL/DECEL ISN'T IMPLEMENTED

The conditions under which accel/decel is not implemented are:

- Ramp time programmed is less than 10 mSec.
- Feedrate for the move is less than 16 units/second.
- Total time for the move is less than 10 mSecs.

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CHAPTER 3: OPERATION OF ACCEL/DECEL

SECTION 3-1 ACCEL/DECEL IN OPERATION

Acceleration and deceleration velocity profiles in Unidex 11 are achieved by updating the clock rate from the indexer at fixed intervals, pre-computed from the programmed ramp time. The minimum clock-rate-update interval is 1 mSec. and the maximum number of updates is 250. If the ramp time programmed is 250 mSecs., the controller increments the clock rate from 0 to the programmed feedrate in 250 steps of a 1 mSec interval. For ramp times less than 250 mSecs. but greater than 125 mSecs., the number of updates is 125 and the interval is accordingly computed. For ramp times between 125 and 50 mSecs., the number of updates is 50. The following table illustrates this:

Ramptime	Number Of Updates	Update Interval (mS)
5000	250	20.0
400	250	1.6
200	125	1.6
80	50	1.6
30	25	1.2
10	10	1.0

In LINEAR accel/decel mode, the clock-rate is updated linearly. In PARABOLIC mode, the clock-rate-update is a parabolic function of time. In the following description, N stands for the number of updates computed from the programmed ramp time as explained above, Fn

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represents feedrate at interval number n and Fp represents programmed feedrate.

The feedrate as a function of an update interval number during acceleration is shown below.

LINEAR

$Fn = (Fp/N) * n$	$n < N$	3.1
$Fn = Fp$	$n = N$	

PARABOLIC

$Fn = (Fp/N) * n(2 - n/N)$	$n < N$	3.2
$Fn = Fp$	$n = N$	

In the linear accel/decel mode, when the programmed move is longer than the ramp time, a trapezoidal velocity profile is achieved. When the move is shorter, (but greater than 10 mSec.), a triangular velocity profile results and the axis does not attain the programmed feedrate. Parabolic profile is truncated when the programmed move is not long enough to attain programmed feedrate.

Figure 3-1 and figure 3-2 illustrate some examples of linear and parabolic ramping in both full and truncated profiling modes.

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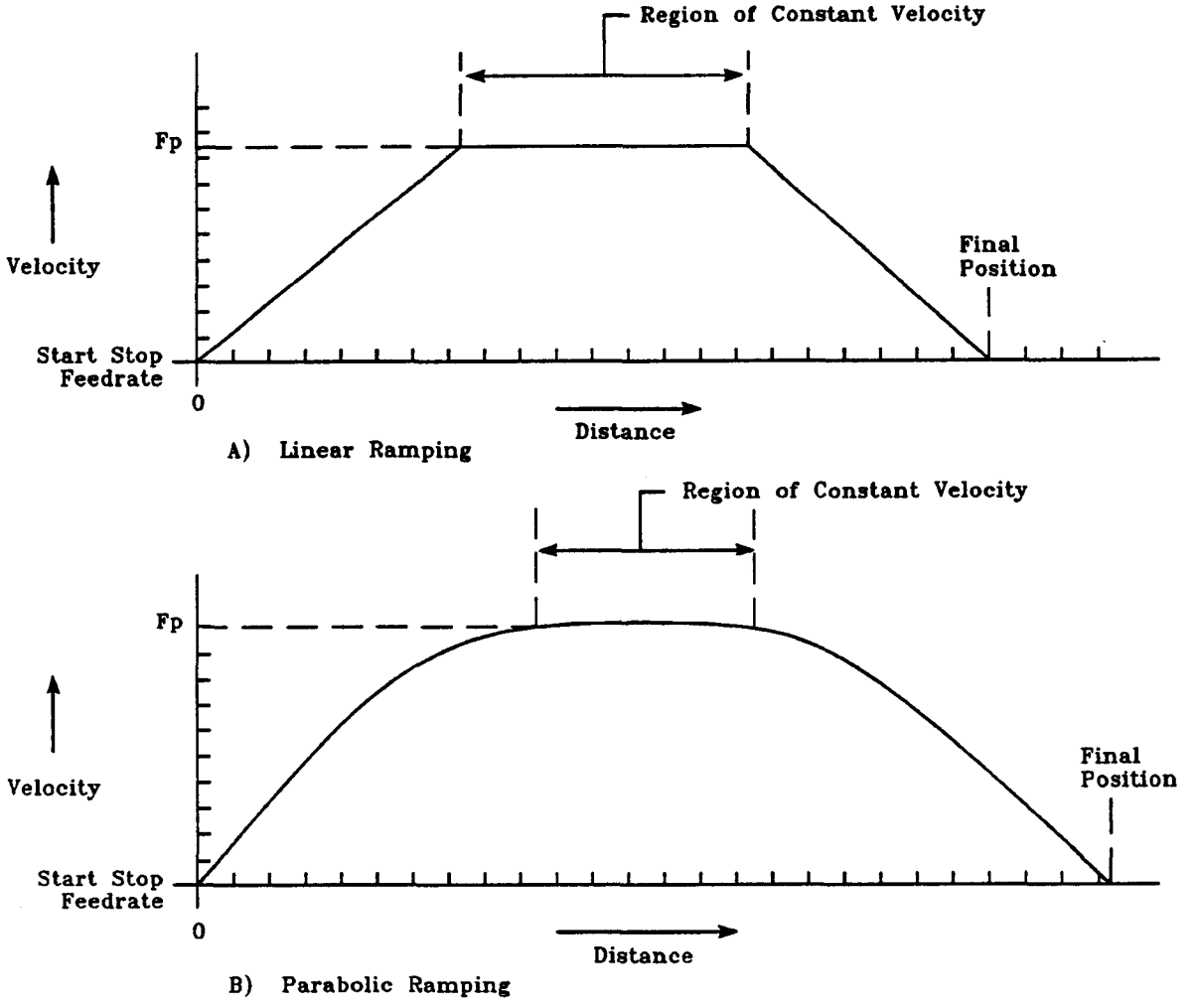
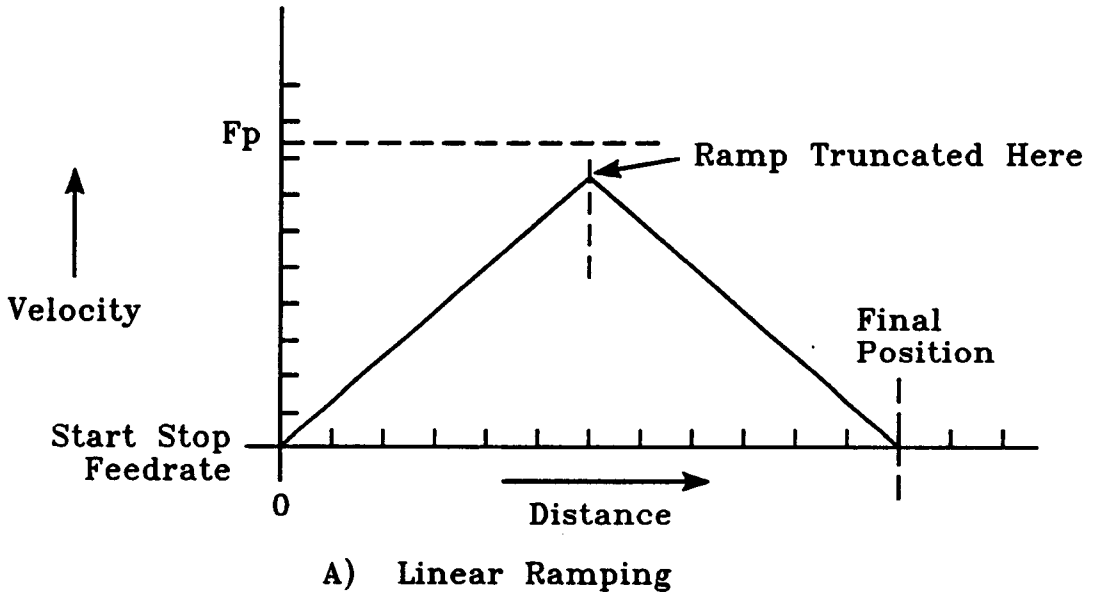
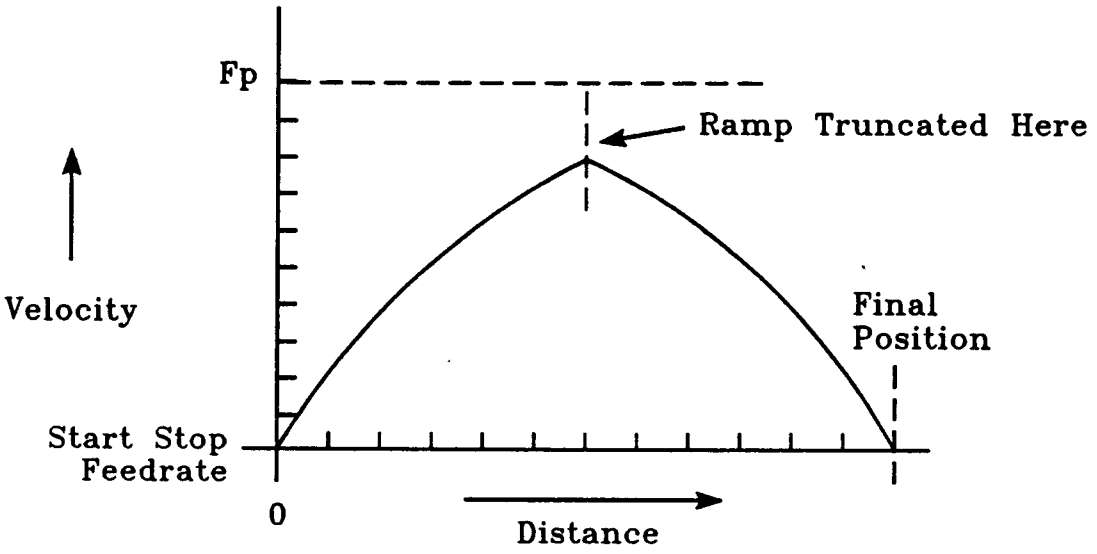


Figure 3-1: Full Ramp Profiles For Linear And Parabolic Ramping

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A) Linear Ramping



B) Parabolic Ramping

Figure 3-2: Truncated Ramp Profiles For Linear And Parabolic Ramping

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SECTION 3-2 RAMPING LIMITATIONS

Accel/decel control in Unidex 11 is implemented with individual hardware VCO (voltage control oscillator) circuitry. Hardware VCOs are used because of the need for feeding back electronic damping control signals from the Aerotech stepping translators when the Unidex 11 is used to control stepping motor systems. Since these VCOs are analog drivers, and operate asynchronously with respect to the indexing circuitry of Unidex 11, user calculated vector motion for any two sets of axes may yield inaccuracies in the trajectory between two given points.

In other words, a calculated vectorial move between two given points of an X/Y plane using accel/decel may produce a slight curvature on the line connecting the two points. For this reason, it is recommended that the accel/decel mode not be used in those cases where precise vectorial motion is required.

This limitation is not considered a flaw in Unidex 11 performance since the basic design criteria for Unidex 11 is two or four axis point to point motion.

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PART IV

RS-232 SERIAL INTERFACE PROGRAMMING OF THE UNIDEX 11

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Appendix 1 ..... RS-232 Command Summary for Unidex 11

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CHAPTER 1: INTRODUCTION

The RS-232 option for the Unidex 11 makes it possible to control Unidex 11 from a host device (CRT terminal, PC, etc.) via the serial port. A simple command sequence through the RS-232 interface gains control of the device. The host may, from this point on, perform different tasks using Unidex 11. These tasks include executing command block(s) in the immediate mode, downloading a program into the user memory, running a program from the memory in auto-run or block-run mode, and reading the axis position, system statuses, directory, program or entire memory.

Unidex 11 may also be set up for interactive control. In this mode, Unidex 11 sends a service request after executing a program or a command block, or if there is an error condition. Subsequently, the host device is required to poll Unidex 11 before proceeding further.

The RS-232 port also allows connecting a passive device (printer, paper tape punch, cassette tape, etc.) to the Unidex 11 so that programs, directory and axis positions may be printed out using the front panel.

Before proceeding, please review Part II (*Menu-Driven Front Panel Programming*) of this manual.

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SECTION 1-1 REQUIRED HARDWARE

The RS-232 port is a standard DB25P connector implementing the following signal lines:

Pin 1	Shield
Pin 2	Transmit Data (TXD)
Pin 3	Receive Data (RXD)
Pin 4	Request To Send (RTS)
Pin 5	Clear To Send (CTS)
Pin 6	Data Set Ready (DSR)
Pin 7	Signal Common
Pin 8	Data Carrier Detect (DCD)
Pin 20	Data Terminal Ready (DTR)

For more information on the RS-232 port, refer to the *Unidex 11 Motion Controller Hardware Manual.*

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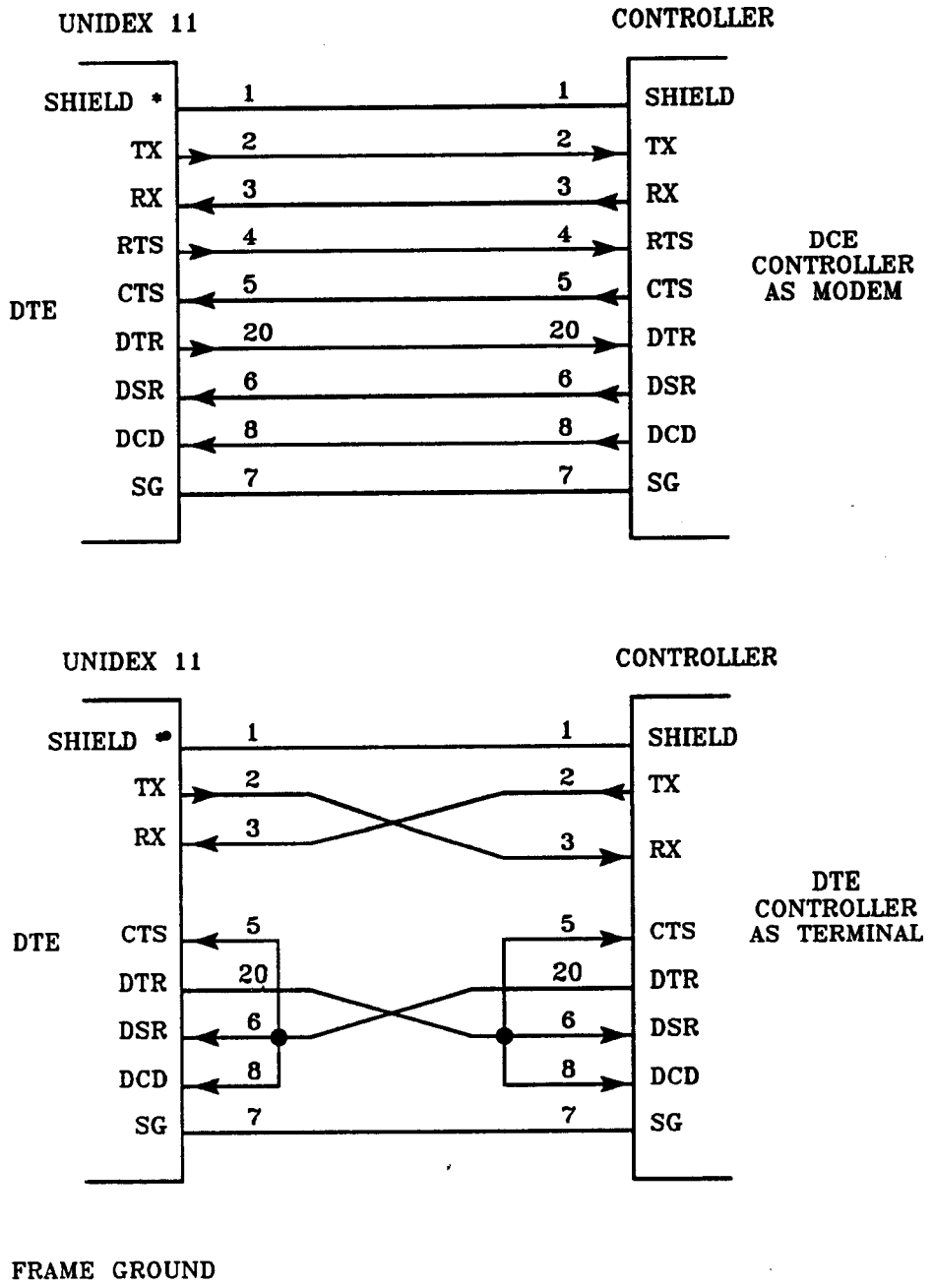


Figure 1-1: RS-232 Connections

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The interface is configured as a DTE and therefore the cabling diagrams shown in figure 1-1 may assist you in selecting the right configuration for your application.

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CHAPTER 2: UNIDEX 11 OPERATION USING RS-232

SECTION 2-1 SETTING UP THE RS-232 FORMAT

It is required that certain communication parameters of the sending device match those of the receiving device to enable data to be transferred. These parameters determine the format for communication. There are four parameters that must be set up in Unidex 11. They are:

Baud Rate - This relates to the rate of transfer of data. The value represents the "number of bits per second" of transfer. Unidex 11 may be set up for a baud rate of from 45.5 to 38400. (Settings include 45.5, 50, 75, 110, 134.5, 150, 300, 600, 1200, 1800, 2000, 2400, 4800, 9600, 19200 and 38400.)

Character Length - Each byte of data is encoded in either 7 or 8 bit length.

No. Of Stop Bits - The end of each byte is indicated by the stop bit sequence. This is also the minimum time required by the receiver to start looking for the next byte after the 7 or 8 bits of the current byte are received. Number of stop bits may be 1 or 2.

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Parity - The parity bit is an extra bit added to the character (in addition to the 7 or 8 bits described above) so as to make the number of "1" bits either even or odd, thus adding an extra check for accuracy of data. Parity may also be disabled so that no parity bit is added. Unidex 11 may be set up for ODD or EVEN or DISABLED parity.

Unidex defaults to the following values upon power-up if there is no battery backed user memory or if the "Load Default" operation is performed.

Baud Rate	**: 1200**
Character Length	**: 7 Bits**
No. Of Stop Bits	**: 1**
Parity	**: disabled**

To change the above values, Unidex 11 has to be put in the Set up mode as described in section 2-2K of Part II of this manual.

Press SELECT until the following Set Up screens are displayed. They will be displayed after the last axis' "Number Of Digits After Point" screen. The display screen will show:

Insert Block Nos. When
Printing Program : NO

Press the +/- key and the "NO" changes to "YES". This feature lets you select whether programs printed on a printer connected to Unidex 11's RS-232 port should contain block numbers. (Printing block numbers may aid in editing a program.)

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Press SELECT for the next Set Up screen:

RS-232 INTERFACE
Baud Rate : 1200

The baud rate may be changed to the value required by successively pressing the +/- key. Unidex 11 can be set up for any one of the 16 different baud rates mentioned previously. These range from 45.5 to 38400.

Press SELECT again to see:

RS-232 INTERFACE
Char Length : 7 bits

Press +/- to change to 8 bits if required.

Press SELECT to see:

RS-232 INTERFACE
Stop Bits : 1 bit

You may change the number of stop bits to 2 bits by pressing +/- key.

Press SELECT to see:

RS-232 INTERFACE
Parity : DISABLE

Press +/- to change parity to ODD. Press +/- again to disable ODD parity and to select EVEN parity.

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After selecting the correct RS-232 formats for Unidex 11, press SELECT to return to the third main screen.

SECTION 2-2 PRINT OPERATION FROM UNIDEX 11

To print from the Unidex 11 front panel interface, press key #4, Print, of the fifth main screen. You will see:

1. POSN	3. PROGM
2. DIR	4. MEMORY

A. PRINT POSITION

Pressing key #1, POSN, sends the position values through the RS-232 interface. For example:

X:AXIS = 0000000000 step
Y:AXIS = 0000000000 step
U:AXIS = 0000000000 step
V:AXIS = 0000000000 step

B. PRINT DIRECTORY

Pressing key #2, DIR, sends a directory listing of your programs through the RS-232 interface. For example:

• UNIDEX-11 DIRECTORY LISTING •
PROGRAM # 25 LENGTH : 00039 BYTES
FREE : 05993 BYTES

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C. PRINT PROGRAM

Pressing key #3, PROGM, sends a Unidex 11 program through the RS-232 interface. Press key #3 to see:

Input Program #
00

Input a program number and press ENTER. If the program is not in memory, you will see:

INVALID PROGRAM #nn
Press BACK to Quit

If program #nn is in memory, you will see:

1. **To Printer**
2. **To Tape**

Press #1, To Printer, to send program "nn" in printer format (i.e., title, margins and optional block numbers). An example (without block numbers) would be:

```
PROGRAM #25  LENGTH : 00039
H XU *
AB *
X F 0001000 D  0000010000
Y F 0002000 R  +
U F 0000500 D -0000002000
V F 0000001 R - *
```


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An example, with block numbers, would be:

```
PROGRAM #25  LENGTH : 00039
0001 H XU *
0002 AB *
0003 X F 0001000 D  0000010000
     Y F 0002000 R  +
     U F 0000500 D -0000002000
     V F 0000001 R - *
```

Press #2, To Tape, to send program #nn in a tape format (i.e., *no* title, margins or block numbers). This function is mainly for off-line storage on paper tape or cassette tape. Each program is preceded by a string "## Enn * <CR><LF>" and followed by a string "% L <10 nulls> <CR><LF>" so that the program can readily be downloaded from the tape to Unidex 11. For example:

```
##E25*
H XU *
AB *
X F 0001000 D  0000010000
Y F 0002000 R  +
U F 0000500 D -0000002000
V F 0000001 R - *
% L
```

D. PRINT MEMORY

Press key #4, MEMORY, to send the entire contents of memory. You will again see:

1. To Printer
2. To Tape

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In this case, *all* programs in memory will be sent in a printer format (key #1) or a tape format (key #2). For example (using a TO PRINTER format):

```
PROGRAM # 25  LENGTH : 00039 BYTES
H XU *
AB *
X F 0001000 D  0000010000
Y F 0002000 R  +
U F 0000500 D -0000002000
V F 0000001 R - *

FREE : 05993 BYTES
```

NOTE: When in the Print mode, Unidex 11 responds to the Xon/Xoff protocol from the device connected to Unidex 11 through the RS-232 interface.

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CHAPTER 3: PROGRAMMING WITH RS-232

SECTION 3-1 COMMUNICATING WITH RS-232

Unidex 11 is ready for communication at power up if the RS-232 format has been correctly set up and the system has a battery back up, or if the default values are already the required format. The host needs only to send an "Attention" command (discussed at the end of this section) at this point.

If any of the Unidex 11 keys is pressed, the communication interface is disabled and Unidex 11 will not respond to commands on the RS-232 line until the interface is enabled from the keyboard. To manually enable RS-232 interface, bring up the fifth screen of the main menu (which is after the fourth screen, described in Part II, section 2-2N):

1. DIG. OUT	3. COMM ENAB
2. ACL/DCL	4. PRINT

Pressing key #3 will take you to the following screen:

1. RS-232/IEEE-488
2. PARALLEL PORT

Press key #1, RS-232/IEEE-488, and Unidex 11 is ready to communicate with RS-232. You will see:

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RS-232 INTERFACE
COMMUNICATION ENABLED

The host device must now send the "attention" command to Unidex 11. This consists of the character string "##" or the character string ">>". The two "#" or ">" signs must be consecutive. Unidex 11, upon receiving the "attention" command, will display:

RS-232 INTERFACE
COMMUNICATION ACTIVE

SECTION 3-2 TYPES OF COMMANDS

Commands sent to Unidex 11 with the RS-232 interface may be classified into two types:

System Commands: These commands interact with Unidex 11 as a device and perform operations such as resetting the unit, printing a program, printing position values, running a program, downloading a program, transferring status byte information from Unidex 11, etc. Each system command establishes a mode of operation once it is received by Unidex 11.

Program (Motion) Comands: These are the user program blocks in a motion program that Unidex 11 executes when running a

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program in the auto or block mode. Program commands are valid only if entered in the immediate or edit mode.

SECTION 3-3 SERVICE REQUEST AND SERIAL POLL

Service request is an important concept in device control when there is a controller (host computer) as the master and the controlled device (such as a printer or Unidex 11) as the slave. The purpose of Service Request is for the slave device to catch the attention of the master controller. Typically a controller has more than one device being controlled by it and it would be very inefficient for the master controller to continually read the statuses of all the devices to check for error states. The controlled (slave) device therefore has the capacity to send a signal (Service Request) to the master controller whenever it requires the attention of the master. The reason for requesting service may be an error condition or to signal the completion of a task.

Unidex 11 implements a service request by sending a predetermined byte of data followed by a <CR><LF>. The controller (master) may be set up to be interrupted by this data byte whereupon it must take a necessary action.

The minimum necessary action that the controller must take once Unidex 11 has sent the service request signal is to poll Unidex 11 by sending the query (serial poll) command Q <CR><LF>. Unidex 11 waits until the query command is received, and will not respond to any other system command until this is done. The purpose of the query command Q <CR><LF> is to transfer a status byte from Unidex 11 to the controller. The 8 bits of this status byte represent different internal states of Unidex 11. Serial polling may be done any time the RS-232 interface is active, not necessarily only after a service request.

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The status byte may be analyzed by the controller to determine the cause of the service request. Each of the bits in the status byte is described as follows:

	ZERO	ONE
BIT 0	Incremental mode	Absolute mode
BIT 1	Not running a program	Running a program
BIT 2	Block run mode	Auto run mode
BIT 3	Non-corner rounding mode	Corner rounding mode
BIT 4	Communication disabled	Communication enabled
BIT 5	Inactive - Not executing a command in immediate mode	Active - Executing command in immediate mode
BIT 6	No service request signal sent	Service request signal sent - waiting for "Q"
BIT 7	No errors detected	Error detected

Unidex 11 may be put into the Service Request Mode by the system command J <CR><LF>. The default Service Request data byte sent by Unidex 11 defaults to "%". Unidex 11 sends:

% <CR><LF>

as a service request signal. This byte may also be programmed by the user by entering a character immediately after J. This entry becomes the new service request character. For example, if

J# <CR><LF>

were entered, the service request character would become "#" and Unidex 11 would send "#" <CR><LF> as the service request signal.

The service request mode may be canceled by sending the system command K <CR><LF>. In this mode, Unidex 11 will not send a

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service request signal for any reason. This is the default mode. In this mode, to determine if an immediate command or a program has been completed, a serial poll (Query) may be done as explained on the previous page and the status byte analyzed (bit 1 and bit 5). When these bits are clear (zero), Unidex 11 is ready to take the next command.

When in the service request mode, Unidex 11 sends a service request (SRQ) character under the following conditions:

- When an Immediate command execution is complete.
- When a program is completely executed in the Auto Run mode.
- When a block is executed in the Block Run mode.
- When a run time error condition is generated and the program is aborted.
- When an axis limit is activated.
- When a program or immediate move is stopped by pressing the STOP key on the front panel keypad.
- At the end of a program download operation if an error was generated while downloading. (The SRQ character is sent by Unidex 11 after the "%" that ends the downloading of the program.)
- When it is requested that a nonexistent program be printed. (If "Pnn <CR><LF>" is sent to Unidex 11 and program #nn does not exist, Unidex 11 will send the SRQ character.)

NOTE: For more information on error bytes, see chapter 4 of this part of the manual (Part IV).

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CHAPTER 4: ERROR CODES

An error condition may be detected by the host computer by checking the most significant bit (bit 7) of the serial poll status byte (section 3-3 of this part of the manual). If this bit is set to "1", an error has occurred.

To further determine the type of error, the system status may be read by the host by sending the command "PS <CR><LF>". Unidex 11 will send back 13 bytes followed by <CR><LF>. (Refer to chapter 5 of this part of the manual for details on printing status byes.) These 13 bytes represent a complete status report of Unidex 11, and are described as follows:

BYTE 1 Same as Serial Poll status byte in section 3-3 of this part of the manual.

BYTE 2 **EDITOR ERROR STATUS:**

	Zero	One
Bit 0	No illegal character during download	Illegal character during download (illegal command code)
Bit 1	Memory not full during download	Memory full during download
Bit 2	No user memory checksum error	Checksum error during download of program

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Bit 3	No illegal command	Illegal command during download (illegal command code)
Bit 4 || Bit 7	Not used	

NOTE: If one of these errors is generated during download operation, Unidex 11 will send an SRQ (service request) character if you are in the Service Request mode. It is recommended that the user then edit and correct that program.

BYTE 3 RUNTIME ERROR STATUS 1:

	Zero	One
Bit 0 *	X axis not in limit	X axis in limit
Bit 1 *	Y axis not in limit	Y axis in limit
Bit 2 *	U axis not in limit	U axis in limit
Bit 3 *	V axis not in limit	V axis in limit
Bit 4 *	No illegal byte in memory	Illegal byte in memory
Bit 5 *	Program number valid	Invalid program number called for run
Bit 6 *	Memory not clear	No programs in memory (Memory clear)
Bit 7 *	No user memory checksum error	User memory checksum error

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BYTE 4 RUNTIME ERROR STATUS 2

	Zero	One
Bit 0	Stop key not pressed	Stop key pressed to stop motion/program
Bit 1 *	No "Repeat Loop End Invalid" error	"Repeat Loop End Invalid" error
Bit 2 *	No "Repeat Loop Incomplete" error	"Repeat Loop Incomplete" Error
Bit 3 *	Eight repeat loops not exceeded	Eight repeat loops exceeded
Bit 4 *	No "Return From Subroutine Invalid" error	"Return From Subroutine Invalid" error
Bit 5 *	No "Incomplete Subroutine" error	"Incomplete subroutine" error
Bit 6 *	Eight subroutines not exceeded	Eight subroutines exceeded
Bit 7 *	No "Missing Label" error	"Missing Label" error

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BYTE 5 COMMUNICATION STATUS 1

	Zero	One
Bit 0	No RS-232 hardware on OP4 board	RS-232 hardware on OP4 board
Bit 1	No IEEE-488 hardware on OP4 board	IEEE-488 hardware on OP4 board
Bit 2	RS-232 communication not active	RS-232 communication active
Bit 3	IEEE-488 communication not active	IEEE-488 communication active
Bit 4	">" or "#" not received	">" or "#" received
Bit 5	No serial poll initiated	Serial poll initiated by sending "Q". Waiting for <CR><LF>
Bit 6	Not in SRQ mode	In SRQ mode
Bit 7	Not in Hold mode	In Hold mode

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BYTE 6 COMMUNICATION STATUS 2

	Zero	One
Bit 0	LCD Display 1 included in system (X and Y display present)	LCD Display 1 not included in system
Bit 1	LCD Display 2 included in system (U and V display present)	LCD Display 2 not included in system
Bit 2	In Hold mode, but no trigger command received	In Hold mode, and trigger command received
Bit 3	Unidex 11 "receive buffer" not full	Unidex 11 "receive buffer" full
Bit 4	Xon received during transmit	Xoff received during transmit
Bit 5	Not in program download mode	In program download mode
Bit 6	Status bytes printed in binary format	Status bytes printed in hex-ASCII format
Bit 7	I/O parallel port input not enabled	I/O parallel port input enabled

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BYTE 7 AXIS VALIDITY STATUS

	Zero	One
Bit 0	X axis not in system	X axis in system
Bit 1	Y axis not in system	Y axis in system
Bit 2	U axis not in system	U axis in system
Bit 3	V axis not in system	V axis in system
Bit 4		
||	Not used	
Bit 7		

BYTE 8 RAMPER BOARD STATUS

	Zero	One
Bit 0	X axis does not have in-position signal	X axis has in-position signal
Bit 1	Y axis does not have in-position signal	Y axis has in-position signal
Bit 2	U axis does not have in-position signal	U axis has in-position signal
Bit 3	V axis does not have in-position signal	V axis has in-position signal
Bit 4		
||	Not used	
Bit 7		

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BYTE 9 AXIS MOTION STATUS

	Zero	One
Bit 0	X axis not moving	X axis moving
Bit 1	Y axis not moving	Y axis moving
Bit 2	U axis not moving	U axis moving
Bit 3	V axis not moving	V axis moving
Bit 4		
||	Not used	
Bit 7		

BYTE 10 FREE RUN MODE STATUS

	Zero	One
Bit 0	X axis not in free run mode	X axis in free run mode
Bit 1	Y axis not in free run mode	Y axis in free run mode
Bit 2	U axis not in free run mode	U axis in free run mode
Bit 3	V axis not in free run mode	V axis in free run mode
Bit 4		
||	Not used	
Bit 7		

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BYTE 11 I/O STATUS

	Zero	One
Bit 0	Input 1 is a 0 (I1)	Input 1 is a 1 (I1)
Bit 1	Input 2 is a 0 (I2)	Input 2 is a 1 (I2)
Bit 2	Input 3 is a 0 (I3)	Input 3 is a 1 (I3)
Bit 3	Input 4 is a 0 (I4)	Input 4 is a 1 (I4)
Bit 4	Output 1 is a 0 (O1)	Output 1 is a 1 (O1)
Bit 5	Output 2 is a 0 (O2)	Output 2 is a 1 (O2)
Bit 6	Output 3 is a 0 (O3)	Output 3 is a 1 (O3)
Bit 7	Output 4 is a 0 (O4)	Output 4 is a 1 (O4)

BYTE 12 AND BYTE 13 DIGITAL OUTPUT STATUS

Bit 0
|| - 12 bit value of digital output
Bit 11

Bit 12
|| - Not used
Bit 15

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CHAPTER 5: TYPES OF COMMANDS

SECTION 5-1 SYSTEM COMMANDS

System commands interact with Unidex 11 as a device and perform operations such as resetting Unidex 11, printing a program, printing position values, running a program, downloading a program, transferring status byte information from Unidex 11, etc. Each system command establishes a mode of operation once it is received by Unidex 11. Each system command must be entered as a capital letter.

A. GETTING UNIDEX 11'S ATTENTION

The system command required from the host device to get Unidex 11's attention and put it into the RS-232 mode, once the communication interface is enabled, is two consecutive "#" or ">". The host must send:

##
or
>

to activate the RS-232 interface.

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B. AUTO MODE

Executing a program in the auto mode enables the program to run automatically, executing the motion commands of the program with no need of further user intervention.

To run a program in the auto mode, send "A", the program number ("nn") and <CR><LF>. Example:

A 10 <CR><LF>

If in service request mode (see section 3-3 of this part of the manual), once the program has been executed, Unidex 11 will send the service request character and wait for a serial poll. After the serial poll, you may execute the same program again by sending another <CR><LF>. To run a different program, send "A nn <CR><LF>" again.

C. BLOCK MODE

A motion program can be run one block at a time, instead of automatically, as discussed in the above subsection. To run a program in the block mode, send "B" for block, the program number ("nn") and a <CR><LF>. Example:

B 10 <CR><LF>

If in service request mode, Unidex 11 will send the SRQ character after each block has been executed. If this is the case, the host must serial poll (see section 3-3 of this part of the manual) Unidex 11 after the execution of each block.

After the execution of the first command block and the serial poll, send a <CR><LF> to execute the next block. Bit 1 of the status

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byte (also in section 3-3) may be checked to detect completion of the program. This bit is cleared after the last block in the program.

D. REMOTE RESET

Sending the command "C" followed by <CR> <LF> resets Unidex 11 after the previous system command is executed. This will take it back to power up conditions. Example:

C <CR> <LF>

E. DISABLING JOYSTICK MODE OR REMOTE MODE

This command is available with the Unidex 11 Joystick (JP4C) option only. For more information on this option, see the *Unidex 11 Motion Controller Options Manual.*

The system command:

D <CR> <LF>

will do one of the following:

1. Disable the Computer Enabled Joystick Mode and return control to the host controller. (The position registers will be updated with the absolute position values before returning control.)

2. Disable the Remote Mode and return control to the host. (The position registers are updated with the absolute position values before returning control.)

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When either the Computer Enabled Joystick Mode or Remote Mode is active, Unidex 11 will only recognize the "D" command and the Serial Poll command. All other system commands will be ignored.

F. DOWNLOADING PROGRAM TO UNIDEX FROM HOST

The "E" command, followed by a program number ("nn") and an end- of-block character (* or /), will put Unidex 11 into the edit mode and set it up to enter the program commands into program "nn" in the user memory. If an existing program with the same number already resides in Unidex 11, it will be deleted automatically when the new program "nn" is downloaded. Example:

E10 * HXY * XF100D1000YF1000D-2000 * %

In the above example, the commands following "E10*" will be downloaded into the Unidex 11 user memory and stored in program #10. The motion commands that may be included in this program will be discussed in section 5-2, Program Commands.

G. DELETING A PROGRAM

In order to delete a program from the Unidex 11 user memory, send the command "E", followed by the character "$", the program number "nn" and an end-of-block character, either "*" or "/". Example:

E $ 10 / (or *)

Program 10 will be erased.

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H. DELETING ALL PROGRAMS (FROM USER MEMORY)

In order to delete all programs from the Unidex 11 user memory, send the command "E", followed by the character "$", two zeros ("00") and an end-of-block character, either "*" or "/". Example:

E $ 00 /

All programs will be erased.

I. BLOCK NUMBERING

If you want programs to be printed with block numbers, send the "F" command and a <CR><LF>. Block numbering may make editing the program easier. Example:

F <CR><LF>

After this command is sent to Unidex 11, any programs will be printed with block numbers.

J. BLOCK NUMBERING CANCEL

In order to cancel block numbering when a program is printed, as established in the above subsection, send the command "G" along with <CR><LF>. Example:

G <CR><LF>

After this command has been sent to Unidex 11, programs will be printed without block numbering.

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The system commands F and G do not change the system set up feature stored in the battery backed memory.

K. HOLD

The command to "hold" the execution of a command string or an entire program is established by the "H" command and <CR><LF>. Example:

```
H <CR><LF>
```

The above command will cause Unidex 11 to suspend execution of any Immediate, Auto or Block commands which may follow it. This is useful if synchronization of axis motion with some other action is necessary. Unidex 11 will only execute the commands when it receives a "T" (for Trigger) command (discussed in a following subsection). Example:

```
H <CR><LF>
A 20 <CR><LF> Program #20 not executed (held)
T <CR><LF>    Now Program #20 executes
```

L. CANCEL HOLD

"O" cancels the Hold ("H") command and allows Unidex 11 to execute the Auto, Immediate or Block command:

```
O <CR><LF>
```

M. IMMEDIATE MODE

The "I" command, followed by motion program commands, an end-of-block character (* or /) and a <CR><LF>, allows a block of

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motion commands to be executed immediately instead of being entered as a motion program. Each block of immediate commands must begin with an I. For example:

I X F10000 D20000 * <CR> <LF>

The above immediate commands will send the X axis 20000 steps at a feedrate of 10000 steps per second (or whatever units might be set in the system). If in SRQ mode, Unidex 11 will send a service request and wait for a serial poll after the command is executed. After being polled, Unidex 11 is ready to execute another block of commands.

All motion commands that make up a Unidex 11 motion program are listed in section 5-2 of this chapter. Although all motion commands are valid in the edit mode, not all are valid in the immediate mode. Following is a list of motion commands that are valid in the immediate mode (for full explanation of each, see section 5-2 of this chapter):

AB*	**HX***	**OT***
AD*	**IN***	**RX***
BF*	**IT***	**SX***
BN*	**LX***	**X F D***
CO*	**NC***	**Y F D***
DB*	**OR***	**U F D***
DD*	**OS***	**V F D***
DW*		

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N. SERVICE REQUEST SET UP

In order to establish the service request mode, send the "J" command, followed by <CR><LF>. After the SRQ mode has been established through the J command, Unidex 11 will send the SRQ signal under conditions described in section 3-3. It will then wait until it receives a serial poll from the host device before executing any further commands. For more detailed information on SRQ, see section 3-3 of this part of the manual.

O. SERVICE REQUEST CANCEL

In order to cancel the service request (SRQ) mode established by the J command (above subsection), send a K command, followed by <CR><LF>. Example:

K <CR><LF>

(SRQ cancelled is the default status.)

P. LOCAL WITH COMMUNICATION ENABLED MODE

The command "L" followed by <CR><LF> puts Unidex 11 into the Local with Communication enabled mode. Example:

L<CR><LF>

This is the state that was originally enabled upon power-up, when key #3, COMM ENAB, of the fifth main menu and the subsequent key #1, RS-232/IEEE-488 were pressed, in order to enable the RS-232 interface.

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Q. STATUS BYTE IN BINARY FORMAT

To establish the format of the status bytes as binary upon transmission, send command "M", followed by <CR><LF>. Example:

M <CR><LF>

Transmission of the status bytes in binary format is the default status.

R. STATUS BYTE IN HEX-ASCII FORMAT

To establish the status bytes in the Hex-ASCII format upon transmission, send the command "N", followed by <CR><LF>. Example:

N <CR><LF>

S. PRINT AXIS POSITION

1. Print X Axis Position (PX)

In order to print the X axis position register, send:

PX <CR><LF>

The axis position is sent in the following format:

<space> or <negative sign> <10 digits> <CR><LF>

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2. *Print Y Axis Position (PY)*

In order to print the Y axis position register, send:

PY <CR> <LF>

3. *Print U Axis Position (PU)*

In order to print the U axis position register, send:

PU <CR> <LF>

4. *Print V Axis Position (PV)*

In order to print the V axis position register, send:

PV <CR> <LF>

T. PRINTING DIRECTORY LISTING

To get a listing of the programs in the Unidex 11 directory, send:

PD <CR> <LF>

Bytes of memory remaining in Unidex 11 will be printed as well. Transmission of data will be terminated by character <ETX>.

U. PRINTING A PROGRAM

To have one program printed, send the command "P", the program number ("nn") and <CR> <LF>. Example:

P10 <CR> <LF>

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The above command will cause program #10 to be printed. Transmission of data will be terminated by character <ETX>.

V. PRINTING ALL PROGRAMS

To have all programs printed, send the command "P", two zeros (00) and <CR><LF>. Example:

P00 <CR><LF>

The above command will cause all programs in memory to be printed. Transmission of data will be terminated by character <ETX>.

W. PRINTING STATUS BYTES

To have the status bytes listed in chapter 4 printed, send:

PS <CR><LF>

Depending on "M" or "N" command, the status will be sent as 13 binary bytes followed by <CR><LF> or 13 sets of 3 bytes (2 hex-ASCII + space) ended by <CR><LF>.

X. QUERY (SERIAL POLL)

The host device may serial poll (Query) Unidex 11 by sending:

Q <CR><LF>

In response to a query, Unidex 11 returns its status byte (see section 3-3) followed by <CR><LF>. The status byte may be one binary byte or 2 hex-ASCII + space, ended by <CR><LF>.

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Y. REMOTE MODE

The system command:

R <CR><LF>

will enable Unidex 11 with the "JP4C" option to be driven through the auxiliary controls. The display shows the remote mode tracking screen:

rtm X: 0000023456 step
rt Y:-0002345.12 mm

The host controller may now signal an external device to take control of Unidex 11.

Unidex 11 keeps track of the axes' positions during external control.

Z. ENABLING JOYSTICK

This command is available with the Unidex 11 Joystick (JP4C) option only. For more information on this option, see the *Unidex 11 Motion Controller Options Manual.*

The system command:

S <CR><LF>

puts Unidex 11 into the "computer-enabled" joystick mode. The display changes to the joystick mode tracking display (see section 2-2H, Part II of this manual).

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In a system with more than 2 axes, the initially active axes will be X and Y. The joystick may now be operated to move the axes.

AA. TRIGGER

To execute the program that is suspended with a Hold command (H), send:

T <CR> <LF>

BB. RESETTING UNIDEX 11

To reset Unidex 11 at any time, you may send the hexadecimal number 7F or FF. Either is the ASCII code for <DEL>.

SECTION 5-2 MOTION PROGRAM COMMANDS

The motion program commands make up the program that Unidex 11 executes when running in the auto or block mode. While all of the program commands are valid in the edit mode, only some are valid in the immediate mode. A list of the motion program commands that will operate in the immediate mode are listed in section 5-1 M (*Immediate Mode*) of this chapter.

A. END OF BLOCK

An end-of-block terminates a block of a program. It may be one of two characters:

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*** or /**

If two or more axes are to run simultaneously, keep those axes commands within one block, i.e., place an end-of-block character after the axes moves have been entered. For example:

```
X F10000 D150000
Y F10000 D150000
V F500 D10000 * (or /)
```

B. AXIS MOTION COMMANDS

The axis to move must, of course, be specified by an axis command (X, Y, U or V).

The speed with which it travels must be specified by a feedrate command (F).

The distance which it is to travel (or the position it is to attain if in the Absolute Mode) is specified with a distance command (D).

An example of a program block utilizing the above commands is:

```
X F10000 D150000 *
```

The above command block would send the X axis a distance of 150000 system units at a feedrate of 10000 system units/second.

NOTE: When programming through RS-232 communication, the feedrate need only be entered with the first index block. After that the feedrate need only be entered if it is to be changed.

1. Axis Free-Run

The axes are commanded to free-run by the command R and a "+" or "-" sign to signify CW (+) or CCW (-). Example:

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```
Y F10000 R+ *
```

The above command tells the Y axis to free-run in the CW direction at a speed of 10000 system units/second.

C. DWELL

A program dwell can be entered into your program with a DW command, followed by the duration of the dwell in tenths of seconds. Example:

```
DW 10 *   or   DW 1.0 *
```

Either above command will cause a 1 second dwell within your program.

D. HOME

Send an axis home with command H followed by the axis or axes to be sent home and an end-of-block character. Example:

```
H X *
or
H XYUV *
```

The first example will send X axis home. The second command will send all axes home.

E. OUTPUT STATE

To establish the output as a 1 (true), a 0 (false) or an X (don't care), send the command "OT" followed by a 1, 0 or X. Example:

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OT 10XX *

In the above example, O1 is to be programmed to a 1, O2 to a 0, O3 is a "don't care" and O4 is also a "don't care". "Don't care" leaves the state of an output unchanged.

F. INPUT STATE

To set up the state you wish the inputs to attain before the program continues, program an "IT" command, followed by the desired states and an end-of-block character. Example:

IT X001 *

The above command states that the program should wait until I2 is a 0, I3 is a 0 and I4 is a 1. State of Input I1 does not matter since it is programmed as a "don't care".

G. OUT/STOP STATE

To output values to the Outputs when the program is stopped (through the STOP key, a feedhold, or pressing key #3 on the front panel), enter the command "OS" followed by the desired values and an end-of-block character. Example:

OS 0011 *

When the program is stopped, a zero will be output on O1 and O2, a one will be output on O3 and O4.

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H. OUT/RUN STATE

To output values to the Outputs when the program is allowed to run again by pressing RUN or releasing the feedhold (after the STOP key, key #3, or feedhold has been pressed), program "OR" followed by the desired values and an end-of-block. Example:

```
OR XXXX *
```

In the above example, when the program run is allowed to continue, the outputs will remain unchanged (all have been programmed as "don't cares").

I. REPEAT LOOP START

The command to start a repeat loop in your program and the number of times the loop executes is established with a "RS" command, followed by the number of times to repeat and an end-of-block. Example:

```
RS 8 *
```

The repeat loop beginning has been marked, and the loop is to be repeated 8 times.

J. REPEAT LOOP END

To mark the end of the repeat loop (discussed in the above subsection), program command "RE" followed by an end-of-block. Example:

```
RE *
```

Repeat loops may be nested to eight levels deep.

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K. CONDITIONAL REPEAT LOOP END

To end the repeat loop based on input conditions, program "RC" followed by the required input state and an end-of-block. Example:

```
RC 10XX *
```

The above example states that the repeat loop will end when the inputs are as follows: I1 is a 1, I2 is a 0. I3 and I4 have no control over the above program block.

L. STARTING FREE RUN AFTER A STOP FREE RUN

After a free run has been stopped (discussed in the next subsection), programming an "R" followed by the axis or axes to be restarted, will start the axis or axes again. Example:

```
R X * (or)
R XYUV *
```

The first example restarts the X axis free run. The second example restarts all axes free run.

M. STOP AXES FREE RUN

To stop an axis or axes' free run, program an "S" command, followed by those axes that are to be stopped, and an end-of- block character. Example:

```
S X *  (or)
S XY *  (or)
S XYUV *
```


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The first example stops an X axis free run. The second stops an X and Y axes free run. The third stops an all-axes free run.

N. REPEAT PROGRAM

To repeat the entire program from the start, enter command "RP" and an end-of-block. Example:

```
RP *
```

Remember, any commands following this command within your program will not be executed.

O. LOAD POSITION REGISTERS

You may load any of the axes position registers with an "L" command, followed by a distance and an end-of-block. The value, which is in system units, may be a positive or negative number or may be a zero. Example:

```
LX0Y0 *
```

In the above example, the X and Y position registers are loaded with zeros. This command may be used to establish an absolute reference position. The axes may be moved to this reference position by programming, in the absolute mode, an Index block with distance values equal to the reference position.

P. INCREMENTAL MODE/ABSOLUTE MODE

In the incremental mode, a distance command tells Unidex 11 how much further to move the axes. For example:

```
X F10000 D1000 *
```


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This command would move the X axis 1000 steps in the CW direction each time it was executed.

Program "IN", followed by an end-of-block, to establish the incremental mode. Example:

```
IN *
```

In the absolute mode, on the other hand, a distance command is an absolute position. For example:

```
X F10000 D1000 *
```

When in the absolute mode, the above example tells Unidex 11 to send the X axis to the position 1000. Once there, the reexecution of the above command will not move the axis any further since it is already at the position commanded. To establish the absolute mode of programming, enter:

```
AB *
```

Q. BEEPER

To turn the beeper ON, program "BN" followed by end-of-block. To turn it OFF, program "BF" followed by end-of-block. Example:

```
BN *
DW .5 *
BF *
```

The above example turns on the beeper for 1/2 of a second and then turns it off.

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R. LABEL

A label (0 to 99) labels a block of program as the place to which the program goes when a GOSUB (go to subroutine) or a GOTO command is encountered. It is programmed with a "LB" command, followed by the number and an end-of-block.

```
LB55*
```

S. GOTO

This command directs program flow to a label. Enter "GT" and a label number, followed by an end-of-block. Example:

```
GT 20 *
```

The above command tells Unidex 11 to continue program execution at label 20.

T. GOSUB

The command that tells Unidex 11 to execute a subroutine at label #nn is the "GS" command, followed by the block label number and an end-of-block. Example:

```
GS 15 *
```

The subroutine to be executed is located at label #15.

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U. SUBROUTINE RETURN

This command causes Unidex 11 to return from the subroutine to the program block that immediately follows the "GS nn" block (described in the previous subsection) . Every subroutine should end with a Subroutine Return.

SR *

Subroutines may be nested to 8 levels deep.

V. PROGRAM STOP

Program stop marks the place in the program at which program execution ends. Enter:

PS *

Subroutines should be placed after this block.

W. CONDITIONAL GOTO

The command "CT", followed by a label number, an "I" and four input values, states that the program should go to a specific block if the input statuses match the specified values. For example:

CT 22 I 10X0 *

The above command tells Unidex 11 to go to the program block labeled "22" when I1 is 1, I2 is 0, and I4 is 0. If the inputs are not these values, continue with the next program block.

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X. CONDITIONAL GOSUB

The command to send the program to a subroutine if the input statuses match specified values is "CS". It must be followed by the label number, an "I" (for input) and the desired input values. For example:

```
CS 33 I 110X
```

The above command tells Unidex 11 to go to the subroutine labeled "33" when the value of I1 is 1, I2 is 1, I3 is 0. If these input conditions do not exist, continue with the next program block.

Conditional subroutines may be nested in combination with regular subroutines to 8 levels deep.

Y. CORNER ROUNDING/NON-CORNER ROUNDING

The command to implement corner rounding is "CO" followed by an end-of-block. Example:

```
CO *
```

The above example would enable corner rounding for all four axes.

The command to go back to non-corner rounding is "NC" followed by an end-of-block. Example:

```
NC *
```

The above command would take all four axes out of the corner rounding mode.

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Z. ACCELERATION/DECELERATION RAMP TIME

The accel/decel ramp time can be programmed in milliseconds by the command "AD" followed by the desired time and an end-of-block character. Example:

AD 10 *

In the above example, the acceleration ramp time as well as the deceleration ramp time will be 10 milliseconds. The maximum value is 4999. This command will be executed only when the required option is included in the system.

AA. BINARY DIGITAL OUTPUT/BCD DIGITAL OUTPUT

To program the Digital Output to be a binary number, enter command "DD" followed by the number ("nnnn") to be output and an end-of-block. Note: (nnnn < = 4095). The binary equivalent of the number you enter will be output. Example:

DD 22 *

In the above example the binary equivalent of the number 22 will be output on the 12 output lines as: 000000010110

To program the Digital Output to be a BCD number, enter command "DB", followed by number ("nnn") to be output and an end-of-block. Note: (nnn < = 999). Example:

DB 22 *

The number 22 will be output in BCD format as 0000 0010 0010. A mSec strobe will be output on the strobe line after the 12 bit value settles.

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BB. END EDIT

The character that is placed at the end of a downloadable file is the percent sign (%). Just place it at the end of your file without an end-of-block. Example:

%

When downloading a program, this character takes Unidex 11 out of the edit mode and back to the system command mode.

SECTION 5-3 SAMPLE RS-232 COMMANDS

A few brief samples will help demonstrate the commands discussed in the last section.

SAMPLE IMMEDIATE COMMANDS

```
##                                  ; Interface active
I H XY * <CR><LF>                   ; Send home X and Y
I X F10000 D10000 * <CR><LF>        ; Move X axis
I Y F10000 D10000 * <CR><LF>        ; Move Y axis
I BN * <CR><LF>                     ; Beeper ON
I BF * <CR><LF>                     ; Beeper OFF
I X F100 D1000 Y F100 D1000 *       ; X and Y axes move
<CR><LF>
```

SAMPLE MOTION PROGRAM

```
##                                  ; Interface active
E 01 *                              ; Edit program 1
H XY *                              ; Send X and Y axes home
X F10000 D10000 *                   ; Move X axis
```


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```
Y F10000 D10000 *          ; Move Y axis
BN *                       ; Beeper ON
DW .2 *                    ; Dwell for 2/10 second
BF *                       ; Beeper OFF
%                          ; End edit mode
```

Send F <CR> <LF> to set Unidex 11 to the block number printing mode.

P01 <CR> <LF>

The above command will cause program #1 to be printed with block numbers.

Cancel numbering with a G command.

Program #1 may be run block by block by sending:

B01 <CR> <LF>

and successive <CR> <LF> for successive blocks. To run this same program in the Auto Mode, send:

A01 <CR> <LF>

It may be deleted by sending:

E $ 01 *

Check your directory with a PD command to verify that program #1 has been deleted.

The X position register may be read by sending:

PX <CR> <LF>

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The Y position register may be read by sending:

PY <CR><LF>

Send J <CR><LF> to put Unidex 11 in the Service Request Mode. (You may enter a character of your own choosing or use the default service request character, %.) When this character is sent by Unidex 11, acknowledge it with a Q <CR><LF> (query) before continuing. If running the program in the auto mode, the service request will come after the program execution. If running a program block by block, it will follow each block.

Send command K <CR><LF> to cancel the service request mode.

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APPENDIX 1: RS-232 COMMAND SUMMARY FOR UNIDEX 11

The following is a list of commands for the Unidex 11 when operating via the RS-232 communication bus in the system command mode.

NOTE: System commands must be entered as upper case letters.

SYSTEM COMMANDS

## or > >	: Activate RS-232 interface
A nn <CR><LF>	: Run program # nn in AUTO mode (nn = 0 to 99).
B nn <CR><LF>	: Run program # nn in BLOCK mode (subsequent <CR><LF> will execute successive program blocks).
C <CR><LF>	: Reset Unidex 11 after previous system command is executed.
D <CR><LF>	: Cancel S or R command
E nn *	: Begin downloading program #nn. Existing program #nn will get deleted automatically.
E $ nn *	: Delete program # nn.
E $ 00 *	: Clear program memory (all programs).
F <CR><LF>	: Insert block numbers when printing programs.
G <CR><LF>	: Cancel block number printing (default state)
H <CR><LF>	: Put Unidex 11 in HOLD mode (Trigger required to execute programs). Hold mode cancelled by O <CR><LF>.
I (string) * <CR><LF>	: Execute program block (string) in the immediate mode.
J <CR><LF>	: Set up Unidex 11 to send Service Request after execution.
K <CR><LF>	: Cancel set up to send SRQ (default state)
L <CR><LF>	: Go to Local with Remote enabled.
M <CR><LF>	: Set up to transmit status in binary format (default state)
N <CR><LF>	: Set up to transmit status in Hex-ASCII format
O <CR><LF>	: Cancel HOLD mode (default state)
PX <CR><LF>	: Print X axis position register value
PY <CR><LF>	: Print Y axis position register value
PU <CR><LF>	: Print U axis position register value
PV <CR><LF>	: Print V axis position register value

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PD <CR><LF>	: Print Directory listing
Pnn <CR><LF>	: Print program #nn
P00 <CR><LF>	: Print all programs in memory
PS <CR><LF>	: Print Status bytes
Q <CR><LF>	: Query (serial poll); Unidex 11 returns a byte
R <CR><LF>	: Enable Remote Mode from host controller
S <CR><LF>	: Enable Joystick Mode from host controller
T <CR><LF>	: Trigger to start program execution
<DEL> (hex 7F)	: Reset Unidex 11

MOTION PROGRAM COMMANDS

* or /	: End of block (terminates block)
X F ffffff D ddddddddd	: X axis move at feedrate ffffff steps/sec a distance of ddddddddd steps, CW
Y F ffff R +	: Y axis feedrate ffff steps/sec free-run CW
U F fffff R -	: U axis feedrate fffff steps/sec free-run CCW
V F ff D - dddd	: V axis move at feedrate ff steps/sec a distance of dddd steps, CCW
	(* placed as required)
DW nnn.n *	: Dwell nnn.n seconds
H X *	: X axis home
H Y *	: Y axis home
H XYUV *	: All four axes home
OT 10XX *	: Output O1, O2, O3, O4
	1: True 0: False X: Don't care
ITX001*	:Wait until input state I1, I2, I3, I4 matches X001
OS 0011 *	: OUT/STOP state
OR XXXX *	: OUT/RUN state
RS nnnn *	: Repeat loop start nnnn times
RE *	: Repeat loop end
RC 10X0 *	: End Repeat loop on input condition 10X0
R X *	: Start free run axis X after Stop (S X)
R YUV *	: Start free run axes Y, U and V
S X *	: Stop free run axis X
S YUV *	: Stop free run axes Y, U and V
RP *	: Repeat Program
L X ddddddddd	: Load position register X with ddddddddd
L Y ddd	: Load Y axis position register with ddd
L U 0	: Load U axis register with 0 (zero).

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L V -dddd	: Load V axis position register with -dddd (* placed as required)
IN *	: Incremental mode
AB *	: Absolute mode
BF *	: Beeper OFF
BN *	: Beeper ON
LB nn *	: Label # nn
GT nn *	: GoTo label #nn
GS nn *	: GoSub label #nn
SR *	: Subroutine Return
PS *	: Program Stop (end of program execution)
CT nn I 10X0 *	: Conditionally GoTo label # nn if input state is 10X0, else continue
CS nn I 1XXX *	: Conditionally GoSub label #nn if input state is 1XXX, else continue
CO *	: Corner rounding mode
NC *	: Non-corner rounding mode
AD nnnn *	: Accel/Decel ramp time in milliseconds
DD nnnn *	: Binary digital output (nnnn < = 4095)
DB nnn *	: BCD digital output (nnn < = 999)
%	: End edit (downloading)

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SERVICE AND REPAIR

General repair of equipment consists entirely of solutions listed in the chapter on Troubleshooting (chapter 4 of Part II of this manual), or the removal and replacement of the Translator or Control Board(s), should the need arise.

If under warranty, repairs of defective electrical components of the Control and Translator boards should not be attempted, since to do so would void the entire warranty.

If necessary, any on-site service should be performed by an experienced electronic technician, preferably one trained by Aerotech.

SHIPMENT

The procedure for shipping equipment back to Aerotech, which is described below, pertains to warranty as well as non-warranty repairs.

1. Before shipping any equipment back to Aerotech, the person making the return must call ahead for a "Return Authorization Number".

2. The equipment being returned must be encased in a proper cushioning material and enclosed in a cardboard box.

Call for a "Return Authorization Number" if it is necessary to ship any part to the factory.

Warning: Damage due to improper packaging voids warranty!

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Aerotech Sales and Service offices are listed below and on the following pages. For service and information, contact the office servicing your area.

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Warranty and Field Service Policy

Aerotech, Inc. warrants its products to be free from defects caused by faulty materials or poor workmanship for a minimum period of one year from date of shipment from Aerotech. Aerotech's liability is limited to replacing, repairing or issuing credit, at its option, for any products which are returned by the original purchaser during the warranty period. Aerotech makes no warranty that its products are fit for the use or purpose to which they may be put by the buyer, whether or not such use or purpose has been disclosed to Aerotech in specifications or drawings previously or subsequently provided, or whether or not Aerotech's products are specifically designed and/or manufactured for buyer's use or purpose. Aerotech's liability on any claim for loss or damage arising out of the sale, resale or use of any of its products shall in no event exceed the selling price of the unit.

Laser Product Warranty

Aerotech, Inc. warrants its laser products to the original purchaser for a minimum period of one year from date of shipment. This warranty covers defects in workmanship and material and is voided for all laser power supplies, plasma tubes and laser systems subject to electrical or physical abuse, tampering (such as opening the housing or removal of the serial tag) or improper operation as determined by Aerotech. This warranty is also voided for failure to comply with Aerotech's return procedures.

Return Products Procedure

Claims for shipment damage (evident or concealed) must be filed with the carrier by the buyer. Aerotech must be notified within (30) days of shipment of incorrect materials. No product may be returned, whether in warranty or out of warranty, without first obtaining approval from Aerotech. No credit will be given nor repairs made for products returned without such approval. Any returned product(s) must be accompanied by a return authorization number. The return authorization number may be obtained by calling an Aerotech service center. Products must be returned, prepaid, to an Aerotech service center (no C.O.D. or Collect Freight accepted). The status of any product returned later than (30) days after the issuance of a return authorization number will be subject to review.

Returned Product Warranty Determination

After Aerotech's examination, warranty or out-of-warranty status will be determined. If upon Aerotech's examination a warrantied defect exists, then the product(s) will be repaired at no charge and shipped, prepaid, back to the buyer. If the buyer desires an air freight return, the product(s) will be shipped collect. Warranty repairs do not extend the original warranty period.

Returned Product Non-Warranty Determination

After Aerotech's examination, the buyer shall be notified of the repair cost. At such time the buyer must issue a valid purchase order to cover the cost of the repair and freight, or authorize the product(s) to be shipped back as is, at the buyer's expense. Failure to obtain a purchase order number or approval within (30) days of notification will result in the product(s) being returned as is, at the buyer's expense. Repair work is warranted for (90) days from date of shipment. Replacement components are warranted for one year from date of shipment.

Rush Service

At times, the buyer may desire to expedite a repair. Regardless of warranty or out-of-warranty status, the buyer must issue a valid purchase order to cover the added rush service cost. Rush service is subject to Aerotech's approval.

On-Site Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or by sending and having the customer install replacement parts, and cannot be returned to the Aerotech service center for repair, and if Aerotech determines the problem could be warranty- related, then the following policy applies.

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs. For warranty field repairs, the customer will not be charged for the cost of labor and material. If service is rendered at times other than normal work periods, then special service rates apply.

If during the on-site repair it is determined the problem is not warranty related, then the terms and conditions stated in the following "On-Site Non-Warranty Repair" section apply.

On-Site Non-Warranty Repair

If an Aerotech product cannot be made functional by telephone assistance or purchased replacement parts, and cannot be returned to the Aerotech service center for repair, then the following field service policy applies.

Aerotech will provide an on-site field service representative in a reasonable amount of time, provided that the customer issues a valid purchase order to Aerotech covering all transportation and subsistence costs and the prevailing labor cost, including travel time, necessary to complete the repair.

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